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USSR Report

SCIENCE AND TECHNOLOGY POLICY

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USSR REPORT

SCIENCE AND TECHNOLOGY POLICY

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COORDINATION OF ACCELERATION OF SCIENTIFIC, TECHNICAL PROGRESS

Moscow Domestic Service in Russian 1440 GMT 19 Jun 85

["Lenin's University of Millions" program; Professor (Stanislav Vitaliyevich Pirigov) commentary: "Coordinated Acceleration of Scientific and Technological Progress--an Important Condition for the Intensification of the Economy"]

[Excerpts] As you know, comrades, the April 1985 CPSU Central Committee Plenum formulated the concept of acceleration of socioeconomic development of the country on the basis of scientific and technological progress. This has been made the basis of the strategic course of the party for the long-term. At the recently held conference at the CPSU Central Committee on the acceleration of scientific and technological progress, it was stressed that in setting the task of accelerating socioeconomic development, the Central Committee has in mind not simply an increase of the rate of growth in the national economy; we are talking about a new qualitative development, rapid progress in strategically important directions, structural rebuilding of production, moving onto an intensive track and efficient management forms, fuller resolution of social problems.

We have something to shout about in our progress. The country has achieved great successes in all spheres of public life. Our economy has a mighty material and technological base that is developed all-round. In comparison with 1940, the value of productive assets has risen almost 16-fold; fuel extraction has increased 7.5-fold, and electricity more than 24-fold. We produce more than all the rest of the world of such important raw material resources as oil, steel and cotton. We possess a huge army of highly qualified cadres in all branches of the national economy. In many of the directions of development of production, science and technology, our country firmly holds the position of world leader.

The working people are participating increasingly widely and more actively in management and in the resolution of state issues. All of this is not just a source of pride for Soviet people, but the basis of the material base and political stability of our society, of social optimism and confidence in the future--a real precondition for further development.

Nevertheless, the 1970's demonstrated distinctly that the high level of dynamism and gigantic scale of our economy require serious reworking of its structure and proportions. Management must find new methods and forms which respond to the requirements of a modern, highly developed economy. The style and psychology of economic management must be radically changed.

Negative phenomena and trends in our economy have signaled the need for restructuring and qualitative changes in economic life, that the build-up of scientific and technological and production potential and the multiplication of the mass of resources drawn into national economic circulation have not been accompanied by the proper returns. Expenditure has risen more quickly than the results. Incompleted facilities have become an inordinately large proportion of capital construction. This has led to the withdrawal from circulation of considerable material values. The building and assimilation of new sites has been extended over long periods. Alongside this we can observe the deterioration in existing production assets. Funds that are clearly insufficient have been allocated for their reconstruction. As a result the quality and reliability of output have decreased and the volume of capital and routine repairs has increased. Almost 28 billion rubles are spent annually in the country on the repair of all kinds of equipment. A considerable part of the machine tool pool of the country--at times up to 60 percent--is occupied with the repair of equipment. The high level of consumption of metal for equipment manufactured in the country gives rise to serious concern: waste and losses in production are great.

What is the reason for the negative phenomena in our economy? The April CPSU Central Committee Plenum gave a direct and principled response to this question: I think that the main thing is that changes in objective conditions of the development of production, the need for its intensification to be accelerated and for changes in economic management were not appraised in the proper way or on time, and what is particularly important--persistence was not manifested in the development and implementation of major measures in the economic sphere, Mikhail Sergeyevich Gorbachev said. In appraising the situation that had developed, the April plenum stressed that the historical destiny of the country and the position of socialism in the world depend on how we proceed with things.

Today, as was said at the CPSU Central Committee meeting, the issue is as follows: To overcome negative trends and to improve things dramatically. Society is faced with an urgent task. We are talking first and foremost of better supply to the population of foodstuffs, satisfaction of the demand for high quality goods and services for the people, improvement of the whole system of health care, development of education, science and culture. The international prestige, the influence of our country in the international arena, and the attractive force of the theory and practice of socialism depend on the efficacy of the course of restructuring the economy. This is why the acceleration of the socioeconomic development of the country is today being accorded paramount political, economic and social importance. The implementation of this course is an urgent affair for the party and the people.

The concept of acceleration of socioeconomic development of the country was born of a realistic appraisal of what has been achieved, of a sober look at the potential of our economy, of a principled party appraisal of the reasons engendering the negative phenomena, of a profound scientific analysis of the modern particularities of the economy and the new demands being made of it.

The party is promoting coordinated acceleration of scientific-technological progress as the main, strategic factor in the intensification of the national economy and better use of the potential that has been developed. The idea that it cannot be tolerated that the tasks which have been set are put off, their resolution is a requirement of everyone, and specific measures are need, ran insistently through the plenum.

At the CPSU Central Committee conference on acceleration of scientific and technological progress, specific measures were mapped out for the achievement of success in this matter of exceptional importance for our country. Once again, the thesis of the need to secure new qualities in our development was heard with all certainty. The crucial point is that for many decades our economic development has been carried out predominantly through large volumes of capital investment, the build-up at rapid rates of capacities in key industries of the national economy, and multiplication of resource potential. This has made it possible to create a powerful, large-scale economy in a short period. But now, this kind of economy--to speak figuratively--needs a new motor which can give it the necessary acceleration, provide a powerful thrust in accordance with its gigantic size and complexity. Scientific-technological progress is this kind of motor for the modern economy.

Moving over to a new kind of drive, of course, presupposes that this drive needs to be managed in a new way. Today we need to find those forms and methods of management that would permit a greater rate of growth in results by comparison with the growth in investment in the national economy to be achieved. In other words, the greatest possible return from every unit of resource expended has to be obtained. Our cadres must understand the vital importance of the reorientation of every enterprise, industry and the whole of the national economy to the intensive path of development, the CPSU Central Committee conference noted.

Science and technology will not produce the desired result if the period for construction and bringing on stream of new projects is not reduced. Otherwise moral deterioration could strike out all the economic advantages of new equipment and technology. The structural changes have to be expressed in priority development of such industries as machine building, electronics, instrument building and others which today mark the main highway of scientific-technological progress.

Reconstruction of machine building was named as one of the immediate tasks at the conference. Capital investment put into this industry is to be almost doubled. In addition, the priority supply of modern types of equipment is envisaged for this industry. At the present rate and scope of development of science and technology, the need for international cooperation is evident. There are considerable reserves here in more efficient cooperation with the CEMA countries, in acceleration and improvement of the structure of foreign

trade turnover and also in introducing order [poryadok] in the use of expensive imported equipment.

The transfer of the economy onto the track of intensification and acceleration of scientific-technological progress cannot be implemented with major expenditure. It requires the mobilization of all forces and funds for the implementation of the planned restructuring of the economy. Under these conditions the struggle for economies is of particular economic and political meaning. Everywhere and in every way the regime of economies should become a law of life for everyone, the preeminent law of running an organization. Everyone knows how great our reserves are, and how far we are from making full use of them. The regime of economies is manifested not just in making rational use of metal and fuel, reducing losses and wastes, and bringing in the resources of economical equipment. The regime of economies also lies in not permitting faults, not producing low quality output. Products which have not found consumers because of their low quality are nothing other than money thrown to the winds. Sciences is at the source of scientific-technological progress. Its acceleration is determined by what scientific potential there is and how quickly it is used for the needs of production. Our country has highly developed science which is a leader in many directions. Annually about 5 percent of the national income is spent on its development.

It is perfectly obvious that the new, qualitative economic development requires a corresponding restructuring of the whole system of running the economy. It is important to create conditions in which enterprises, associations and ministries are vitally interested in the acceleration of scientific and technological process, so that without it they simply cannot live and develop. For this to happen we have to change priorities in appraisal of economic activity and move decisively away from the predomination of gross values. The strengthening and development of the principle of democratic centralism, skillful use of financial autonomy and the goods-money relationship, and the development of independence and initiative at enterprises and associations are of particular importance in improving management. Integrity--an all-embracing nature--is a decisive condition for the restructuring of management. This integrity should be realized at all levels of the economy, beginning from Gosplan and the leading departments to the labor collectives and teams.

To sum up, success will come, if every Soviet person, every working person accepts this work as an affair that concerns them closely, and demonstrates a high level of creative effort, awareness and organization.

CSO: 1814/204-F

ORGANIZATION, PLANNING AND COORDINATION

PROBLEMS, GOALS OF UZBEK SCIENTIFIC, TECHNICAL PROGRESS

Tashkent EKONOMIKA I ZHIZN in Russian No 4, Apr 85 pp 28-31

[Article by Candidate of Economic Sciences V. Dubov, deputy chief of the Science and Technology Department of the Uzbek SSR State Planning Committee: "The Path From the Idea to Introduction Should Become Shorter"]

[Text] The higher the scientific and technical level of the national economy is, the more appreciable the efficiency of national labor is. According to the calculations of economists, the implementation of the achievements of scientific and technical progress provides about 75 percent of the increase of labor productivity, over 50 percent of the increase of the national income and approximately half of the decrease of the production cost of industrial products.

A mighty scientific and technical potential, which is having an ever increasing influence on the development of the republic economy, has been created in Uzbekistan. Tens of scientific research and planning and design organizations and higher educational institutions, which unite an army of 40,000 scientists, annually turn over for introduction in the national economy more than 400 scientific and technical developments. The total efficiency from their introduction exceeds hundreds of millions of rubles.

Research and the practical implementation of developments in the area of irrigation construction, the genetics and agricultural technology of cotton and the mechanization of the processes of its cultivation and processing are contributing to the successfully development of the republic cotton complex. The works of scientists in the area of electronics, nuclear physics, mechanics, seismology, bioorganic chemistry, activation analysis and so on are being used extensively in ferrous and nonferrous metallurgy and in other sectors of industry and construction. In the end all this finds reflection in the increase of the scale of the use of advanced technological processes, the provision of production with means of complete mechanization and automation and the increase of its efficiency and product quality. As a result of providing production with new machines and equipment the capital-labor ratio in republic industry in 4 years has increased by nearly one-third. Here the relative freeing of workers comes to more than 25,000. The economic impact from the implementation of measures exceeds 250 million rubles.

However, in spite of the ever increasing scale of the use of the achievements of science and technology in production, the state of affairs in this area is causing some anxiety.

The technical innovations, which the national economy needs very much, at times make their way into the world intolerably slowly. Many types of equipment and models of advanced technology and organizational innovations exist too long in a single copy. Why does this happen?

As the analysis shows, the most vulnerable section in the chain of the introduction of the achievements of scientific and technical progress in production is found at the stage of the pilot experimental checking of the scientific idea and the organization of the industrial production of new equipment. Precisely here the time of introduction is dragged out due to the lack of coordination of actions between the two participants in social production--science and practice, and this leads to vast national economic losses.

For nearly 10 years the Uzbek SSR Ministry of the Construction Materials Industry has not been able to assimilate the new highly efficient low-temperature sill technology, which makes it possible to decrease the consumption of fuel and electric power for the production of each ton of cement by 25 percent. The discussion of the utilization of phosphogypsum, the use of which in the cement industry, as well as for the production of linoleum and ceramic items would yield an economic impact of over 10 million rubles a year, is being conducted not for the first year--and so far effective steps have not been taken in this direction. The cyclone-type burner, the use of which ensures the substantial increase of the productivity of cement kilns, is also not being introduced.

The question of the construction of an experimental plant for the production of chlorella paste, on the importance of which in agricultural production the journal EKONOMIKA I ZHIZN has written more than once, has existed in the Uzbek SSR Ministry of Agriculture since 1976.

The republic Ministry of Light Industry simply cannot solve the problems of the extensive introduction of conveyors for the transportation and storage of cocoons (the anticipated economic impact would come to not less than 1.8 million rubles a year). The same situation has also formed with the unit for the removal of gold from the broken utensils and with the introduction of means of mechanization for the loading and unloading of hides in tanning. It would be possible to continue this list further.

In our opinion, many economic, organizational, legal and other problems, which are different in importance and difficulty and require immediate solution, have accumulated in the area of the management of scientific and technical progress. One of them is the increase of the interest and initiative of enterprises, associations and sectors of industrial production in the acceleration of scientific and technical progress. This question is closely connected with the improvement of the planning of scientific and technical progress.

At present the planning of the process of the development and introduction of new equipment is carried out primarily by means of natural indicators, which are approved within a special section of the plan on new equipment. These indicators are not properly connected with the economic indicators of the other sections of the plan--the production volume, labor productivity, the decrease of the production cost and others, which characterize the end results of production activity. Whereas the latter are strictly monitored and the plans on them, especially on the volumes of the production of output, as a whole are fulfilled and even exceeded, the fulfillment of the plan assignments on new equipment is characterized by a chronic lag. This is also understandable: for the economic activity of the enterprise, the amounts of the economic stimulation funds and the payment of bonuses to workers--all this is determined and evaluated by the indicators of the production plan. As to the plan on new equipment, the upsetting of its assignments is far from always taken into account.

In this connection the approval of a plan indicator of the effectiveness of the introduction of new equipment seems necessary--"the saving from the decrease of the product cost due to the increase of the technical level of production" could become it. In order to increase as much as possible the interest of the workers of enterprises in the introduction of the achievements of science and technology, it is advisable to group the indicated indicator with the fund-forming indicators, and first of all with those which form the material incentive fund.

The further enhancement of the role of economic stimuli, which increase the interest in the removal from production of obsolete types of products and the assimilation of new ones, could also contribute to the acceleration of scientific and technical progress. So far the issue of removing products from production in many cases has been settled administratively, and not by the method of economic influence. This to a significant extent is explained by the formed system of the material stimulation of the development of production--it encourages primarily the output of an already assimilated product, even if this product in its technical and economic parameters is obsolete. The introduction of new types of equipment, as a rule, requires additional work--on the preparation of the production engineering base, the setting up of new cooperative relations, the retraining of personnel. Here the assimilation of the output of new items involves the decrease of the profitability of production, which entails a decrease of the amounts of the deductions for the economic stimulation funds.

Obviously, it is necessary to adjust the economic mechanism so that the output of obsolete products would be unprofitable of the enterprise and, what is more, so that the material status of the workers, who produce such products, would automatically worsen. In this connection the formation of the prices for new and old products requires further improvement--it is necessary to eliminate the basic contradiction: the high profitability of old, obsolete equipment and the low profitability for the period of the assimilation of new equipment. It is possible to resolve this contradiction by the introduction of the strict monitoring of the wholesale prices for products. The prices should reflect the actual use value. And this means that the prices for

obsolete products should be significantly less than the wholesale price for new products.

Apparently, the need has arisen to establish wholesale prices for a strictly defined period (for approximately 7-8 years--the average time of the obsolescence of equipment), after which they should be revised downward. Moreover, this decreasc should appreciably affect the economic indicators of the enterprise which produces obsolete products. Thus, the new wholesale price for obsolete products can be established at the level of the production cost which has been achieved by the time of the revision of the initial price.

It is important to stress that a decrease should be made even if by this time new, more efficient equipment or products have not been developed (true, it should be somewhat less than in the first case). The wholesale price can be maintained only if by the moment of the end of the effect of the initially established price the product is not obsolete and its technical and economic parameters are maintained at the level of world standards. However, in this case the new term of effect of the wholesale price should be greatly limited (to not more than 3 years), after which it should be revised again--in order to conform to its use value.

Such an approach to the matter fully satisfies the requirements of the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy." The introduction of the price system proposed above would make the economic activity of enterprises strictly dependent on the rate and extents of the use of the achievements of science and technology. And then, perhaps, we will achieve such a situation, in case of which enterprises will themselves seek innovations and models of new equipment and will not "repulse," as now frequently happens, the attempts to include the assimilation of new products in the plan.

The very principle of the approach to the drafting of such a section of the plan of economic and social development as the production plan (production program) also requires further improvement. It should be examined in fundamental connection with the plan on new equipment. It would be advisable to begin the formation of the nomenclatural breakdown of the production plan with thc specification of the assignments on the removal of obsolete products and the placement into production of new equipment. The plan on new equipment should be included in the nomenclatural production plan and become its main component. Only in this case will the actual coordination of the different sections of the plan be achieved and will the assignments on the introduction of new equipment receive resource backing.

Quite often the practical assimilation of the achievements of science and technology is checked due to the lack of preparation of the enterprise to place new products into production and due to the lack of the production capacities necessary for this. The goal program method of planning, of which the comprehensive goal and scientific and technical programs are a form of manifestation, can and should eliminate or at least drastically reduce the influence of this factor on the process of introducing new equipment. They make it possible to concentrate forces and material assets on the achievement

of the ultimate goals and to ensure the comprehensiveness of the solution of the most important national economic problems and the continuity of the implementation of the necessary measures. The goal program method makes it possible to identify and take into account the relations between sectors, which is especially important when accomplishing those tasks of scientific and technical progress, which it is difficult to carry out within sectorial plans. The practical use of comprehensive programs makes greater demands on the efficiency and coordination of the work of related enterprises and sectors and on executive discipline and makes it possible to prepare production in advance for the fulfillment of a specific assignment or stage of the work--owing to this the expenditures of time on the development of new equipment over the entire "science-production" cycle, that is, from the idea to introduction, are drastically reduced.

Substantial experience in the solution of scientific and technical problems on the basis of developments of comprehensive goal programs has been gained in our republic. During the current five-year plan the scientific and planning and design organizations, enterprises and associations of the republic are taking part in the fulfillment of more than 80 union and 19 republic programs. However, it should be borne in mind that the comprehensive programs presently being formulated, as a rule, are aimed at the solution of some one important scientific and technical problem. The task is to achieve the extension of this method to the entire process of production operations. The point is for every enterprise to make the goal assignments of the Comprehensive Program of the Increase of the Technical and Economic Level of Production the basis of its development. The formulation of such a program will make it possible to combine in a single document the measures on the introduction of advanced types of equipment and technology and the mechanization and automation of production, envisaging on this basis the increase of labor productivity, the improvement of product quality and the decrease of the consumption of manpower, raw material, fuel and energy resources.

The system of the management of scientific and technical progress in the territorial context, on the level of the union republic, so it seems to us, also awaits its improvement. In recent years the sphere of scientific research in the union republics has been significantly expanded. However, the organization of the management of this complex process has remained unchanged in them. The existing system of the administrative management of institutions of science, just as before, envisages the division of scientific and technical activity into three spheres: the academic sphere, the sphere of higher educational institutions and the sectorial sphere. Each of them has its own management organ--the presidium of the academy of sciences, the ministry or the department--and management is carried out by them without regard for each other. As a result unjustified duplication and parallelism arise in the research being conducted.

The attempts to coordinate the work by means of an interdepartmental organ--the Council for Coordination, which has been set up in the republic--showed that such an organ's lack of administrative rights and financial and economic levers of influence on the process of the acceleration of scientific and technical progress does not enable it to cope with its tasks.

The question of the founding in the republic of a state organ--with the rights of a union republic department, which would be included in the system of the USSR State Committee for Science and Technology and would implement the functions of this committee on the territory of the republic, has become urgent.

The republic committee for science and technology, having assumed the solution of the entire complex range of problems connected with the management of scientific and technical progress, would contribute to the further integration of science and production, the significant shortening of the path "from the idea to introduction" and, hence, the increase of the efficiency of social production.

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ORGANIZATION, PLANNING AND COORDINATION

ISOOPTIC R&D DROPPED, CAREERS DAMAGED IN INSTITUTE DISPUTE

Moscow IZVESTIYA in Russian 18 Aug 85, No 230, (21307), p 3

DEMENTYEVA, I., correspondent

[Abstract] The lengthy article relates the story of how a conflict within a research institute's administration led to the removal of support from a promising technology called isooptic thermometry, and to intentional damage to the careers of two staff members, a husband and wife who are credited with discovering and pioneering the technology. The author of the article states that the purpose of the article was not to delve into fine points of technology and its merits, but to shed light on the 'human factor of technological progress.' It is stated in the article that isooptic thermometry was deemed a promising method of nondestructive testing which had the potential for savings of 5 million rubles in the electronics industry alone.

The husband and wife were engineer Yu. Voytsekhov and Candidate of Technical Sciences M. Chernyakova. The husband headed an instrument-making sector of the institute, which is not identified my name, and the wife was an engineer in another sector. When they discovered the method and first began working on its applications, they won support for their work. It is noted that in 1980, Chernyakova was appointed director of development of isooptic thermometry at the order of the industry's minister. Voytsekhov's sector was also assigned to work on the technology. The work reportedly produced prototypes of efficient heat sensors that could be made in the form of tablets, films and even pastes. When difficulty was encountered in getting industry to cooperate with the institute on producing isooptic sensor devices, the ministry's main administration decided to create an industrial sector at the institute, and Chernyakova was put in charge of it. It is suggested that this created new tasks for the institute's administration which it did not want. Not long after, a new deputy director in charge of research was named at the institute. Sensitive to growing friction which is implied to have been motivated by jealousy, he made a decision to close the industrial sector. Soon thereafter, Voytsekhov was demoted from chief designer to deputy chief designer. The article says that the new chief designer, V. Prokhorov, was a known opponent of isooptic thermometry, and the move was made intentionally.

The article goes on to recount how the opposition poured over into attempts to completely discredit Voytesekhov as a scientist. In the course of the conflict,

he was in the process of defending a candidate of sciences dissertation at the Leningrad Institute of Precision Mechanics and Optics. The administration of his institute is said to have made attempts to interfere with the defense, and when the degree was conferred upon him nonetheless, the administration continued its attempts to discredit him with the Higher Academic Degree Commission, even raising questions of 'moral character' when his qualifications as a scientist were upheld by expert commissions.

In conclusion it is noted that an authority on heat conditions of electronic apparatus, Prof G. Dul'nev, has judged isooptic thermometry to be a promising method, and its support by various scientific committees and publications is noted. But its fate is said to be in question due to the conflict that was cause by the institute's administration.

FTD/SNAP
CSO: 1814/279

ORGANIZATION, PLANNING AND COORDINATION

BOOK ON PLANNING OF SCIENTIFIC, TECHNICAL PROGRESS

Moscow OBSHCHESTVENNYYE NAUKI V SSSR, SERIYA 2: EKONOMIKA (REFERATIVNYY ZHURNAL) in Russian No 1, Jan-Feb 85 pp 60-64

[Review by L. K. Semenov of book "Planirovaniye nauchno-tekhnicheskogo progressa" [The Planning of Scientific and Technical Progress], edited by P. A. Sedlov, the Institute of Economics of the USSR Academy of Sciences, the Problem Council for Economics, Nauka, Moscow, 1984, 240 pages]

[Text] The book consists of an introduction and 11 chapters. It was written by a collective of authors consisting of: A. N. Andrukhovich, V. Yu. Budavey, T. N. Kalinovskaya, B. P. Krasnoglazov, V. M. Likhtenshteyn, L. I. Maksimov, V. L. Mereshko, Ye. V. Sapilov, P. A. Sedlov, T. L. Sletova, K. I. Taksir and Yu. A. Tushnov.

In the first three chapters the general problems of the planning of scientific and technical progress are examined: the role of planning as the basic tool of the acceleration of scientific and technical development, the structure of the plans on new equipment and the basic directions of the improvement of planning during the 11th Five-Year Plan are revealed. The study begins with the analysis of the category "new equipment." The lack of precise criteria in the determination of the novelty of equipment, which in the end leads to the decrease of the rate and scale of the assimilation of advanced types of products, which are based on major inventions, is pointed out. In the opinion of the authors, there should be grouped with new equipment only the equipment being newly developed and assimilated, which can yield a socioeconomic impact and exceeds in technical level domestic scientific and technical achievements. The planning, financing and stimulation of already assimilated equipment should be carried out without the extension to such items of the procedure which has been established for new equipment. Such a stand of the authors made it possible to formulate a set of indicators of the plans on new equipment, which is characterized by specificity and an orientation toward the end results. It is proposed to include in the volume of output not only the value of prototypes, but also the value of the work of an industrial nature on the improvement of production, the assimilation of new equipment, mechanization and so forth. Then the assignments on the deliveries of products and scientific and technical progress will be contained within a unified plan, and the evaluation of the work of the enterprise will reflect

both the successes in economic activity and the achievements in scientific and technical progress.

The possibility of managing scientific and technical progress by the implementation of the unified scientific and technical policy (YeNTP)--a set of unified state principles, requirements and methods of the planned management of scientific and technical development, which is formed with allowance made for the socioeconomic tasks of socialist society--exists under the conditions of the socialist system of management. The peculiarity of the unified scientific and technical policy consists in the centralized nature of its pursuit and the use along with methods of economic stimulation of directive actions on the part of the state.

In examining the directions of the improvement of the planning of scientific and technical progress at the present stage, the authors note the efficient combination of sectorial and intersectorial planning; the transition from the development of individual types of new equipment to the planning of the development and production of systems of machines and equipment; the increase of the comprehensiveness of the planning of both the entire processes of the development, assimilation and introduction of new equipment and its individual stages. During the 11th Five-Year Plan the time horizon of planning has been broadened, the final stages of the implementation of the programs being formulated with an indication of the amounts of introduction for the last year of the next five-year plan and others are envisaged in the plan.

Particular attention during the current 5-year period is being devoted to the more extensive use of the goal program method of planning of scientific and technical progress. The fourth chapter is devoted to these questions. The advantages of this method as compared with traditional methods are: the precise goal orientation toward the meeting of social needs, the determination of the priorities of the realization of the goals, the comprehensive and balanced supply with all types of resources, the variant analysis of the means of solving problems, the organization of close intersectorial and interdisciplinary cooperation and the evaluation of the end national economic results. Comprehensive goal programs are the basic form of the use of the goal program method in planning. They are formulated for the large-scale implementation of the most significant scientific and technical achievements, the use of which ensures already in the immediate future the substantial increase of production efficiency and work quality. The end results of goal programs are indicated in the form of the volumes of the production and industrial assimilation of objects of new equipment, as well as the output of already assimilated advanced types of products or ones which have begun to be assimilated. Programs are also formulated on the solution of the most important scientific and technical problems, which are of great national economic importance and are connected with the development of fundamentally new types of equipment and with the development of scientific research and development in the most promising directions of science and technology for the creation of a reserve for the coming period.

At present the day-to-day management of intersectorial programs is broken up and is carried out independently by ministries, organizations and enterprises, which are performers. The main ministries, which are responsible for the

fulfillment of the program as a whole, in practice do not have levers of influence on the coperformers outside their sector. It is advisable to base the management of scientific and technical programs on the temporary centralization in management organs of the functions of resource supply, monitoring, accounting and special-purpose stimulation. The authors propose to give the main organization the right to to dispose of the assets which are allocated for the fulfillment of the corresponding amounts of work on the program, having increased in this case its responsibility for the observance of financial discipline, the drawing up and expenditure of the estimates and others.

A number of chapters (the fifth through ninth) are devoted to the study of the problems which arise at the final stage of scientific and technical progress; the increase of the technical level of industrial products, the improvement of the mechanism of the selection of new equipment, the stimulation of the increase of the quality of new equipment at the stage of the preparation of production and the production assimilation of unique objects of new equipment. In pointing out the shortcomings inherent in the prevailing system of the planning of the updating of products, the authors propose to use a more detailed gradation of products according to the technical level. At present the indicators and norms of quality, which are approved in the standards, reflect the already achieved level of series-produced products, that is, specify the minimum necessary demands on their quality. In the opinion of the authors, the introduction of a procedure, in case of which scientific and technical developments would conclude with the approval of a long-range standard which establishes leading indicators of quality for the given type of products, is necessary. In such a standard it is advisable to envisage an indicator of the expenditures per unit of effective impact of new equipment, the decrease of which is the most important criterion of its actual efficiency.

The authors come to the conclusion that comprehensiveness in the use of all the existing forms of the economic stimulation of the process of producing new machines is the basic principle, to which attention should be directed when improving the economic planning mechanism of the assimilation of new types of equipment. The implementation of this principle should be carried out in the direction of the achievement of the maximum unity of the influence of material stimuli, the direct coordination of the planned influence of all types of plans and the inclusion of not only the economic, but also the other types of impacts from the use of new equipment in the criterion of the evaluation of the labor activity of the individual subdivisions of the group of the preparation of production in case of the determination of the bonus payments. The existing practice does not orient enterprises toward the timely achievement of the planned technical and economic indicators and does not prompt them to seek reserves of the increase of labor productivity during the period of assimilation. The planning of production during the period of assimilation requires the existence of standards which make it possible to determine the magnitude of the economic indicators of the operation of the object at any moment of this period. In this connection the authors attach great importance to the development of the methodology of determining the economic losses which are connected with the process of assimilating new

equipment. The methods of calculating the standards of losses, which are proposed in the literature, are analyzed.

The questions of the specialization of intersectorial works are studied in Chapter 10. Two directions of the improvement of the specialization of tool production are noted: the establishment of specialized enterprises, shops and sections in individual sectors of machine building and the organization of base shops and sections at machine building plants.

Chapter 11 is devoted to the questions of the planning of scientific and technical progress in the CEMA countries. It is pointed out that the planning of scientific and technical progress in the fraternal socialist countries is based on a unified technical policy which is constantly coordinated on both a bilateral and a multilateral basis. The experience of the Soviet Union is being used to a greater extent in case of the formulation of scientific and technical policy. However, in each of the countries owing to national peculiarities there is its own specific nature. The systems of the planning of scientific and technical progress of Bulgaria, Hungary, the GDR and Romania are analyzed. The directions of the development of the management of scientific and technical progress in the Socialist Republic of Vietnam and Cuba are examined.

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ORGANIZATION, PLANNING AND COORDINATION

BOOK ON MANAGEMENT OF PRODUCTION OF NEW EQUIPMENT

Moscow OBSHCHESTVENNYYE NAUKI V SSSR, SERIYA 2: EKONOMIKA (REFERATIVNYY ZHURNAL) in Russian No 1, Jan-Feb 85 pp 56-59

[Review by A. I. Perchik of book "Sovershenstvovaniye upravleniya proizvodstvom novoy tekhniki" [The Improvement of the Management of the Production of New Equipment] by A. L. Semenov, Nauka, Moscow, 1984, 168 pages]

[Text] The problems of improving the management of scientific and technical progress in the area of the production and dissemination of new equipment are studied in the book (an introduction, four chapters and a conclusion).

In the first chapter "The Management of the Production of New Equipment" the process of producing new equipment as an object of management and the economic and organizational mechanism of the management of this production are discussed. It is emphasized that the criterion of the economic novelty of equipment is its impact: "...equipment will be considered new for the national economy," the author writes, "while its use ensures the obtaining of a socioeconomic impact" (p 10). Such an approach makes it possible to substantiate the time, during which the output of products will be advisable, and the phases of their production. Three phases of the production stage of the scientific and technical cycle are distinguished--the assimilation, the dissemination and the curtailment of the production of the given type of equipment, the continuity and content of which are determined by the dynamics of its impact. This point of view enabled the author to decide in favor of theoretical questions of the management of the production of new equipment: to examine the problems specific to each of the phases of the cycle and the forms of the process of disseminating new equipment, to single out the factors which govern the development of this process. On the basis of the analysis the demands made on the system of the management of scientific and technical progress by the given object were formulated: the system should be sufficiently complete and developed and should conform to the complexity of the object; its components should be oriented toward the socioeconomic impact of new equipment; the system should be based on a long-range approach, which corresponds to the goals and time of the development of scientific and technical progress. The mechanism of the management of scientific and technical progress--planning, financing, pricing, stimulation, the system of organs of the management of the production of new equipment--is examined in

detail. The shortcomings the the existing management system are critically appraised.

In the second chapter "The Management of the Production of New Equipment On the Basis of the Forecast of the Need" it is a question of the strategy of the production of new equipment, the formulation of this strategy on the basis of the forecast of the need and methodological problems of determining the need for new equipment.

By the strategy there is meant the approach to the elaboration of a planning concept, which includes the set of goals and the resources required for their achievement. This strategy should ensure the optimum rate of introduction, should eliminate the duplication and parallel performance of experimental operations and should substantiate the capital investments in the given technology. The concepts "the strategy of the development of the production of new equipment," "the innovation strategy" and "the strategy of the introduction of a new product" are also used extensively in foreign literature. The analysis of the market--the determination of its volume and structure and the demand for the new product--is the initial stage of the elaboration of the strategy. It is possible to use the experience of strategic planning, which has been gained by capitalist firms, in the practice of socialist management, but with allowance made for critical analysis. "The problem of determining the volume and structure of the market," the author writes, "under the conditions of the socialist system of management assumes importance as the problem of determining the national economic need for new equipment and of establishing contacts of the producers of new equipment with its users" (p 64).

Proceeding to the methodological problems of determining the need, A. Semenov singles out the need for new equipment as a special economic category. The introduction of the latter in economic science is connected with the need for a long-range approach to the planning of the production of new equipment and with the mandatory nature of the consideration of the dynamics of its socioeconomic impact. The necessity of the more extensive use and development of the methodology of forecasting the need on the basis of mathematical economic models is the conclusion to which the author comes in the process of his study.

In the third chapter "The Modeling of the Process of Producing New Equipment" the author dwells on the analysis of the prerequisites of the production of new equipment, the models of technological substitution and the problems of forecasting the need on the basis of these models.

A number of prerequisites, which make it possible to group the set of existing models and to make an "inventory" of them, are given. During the analysis the prerequisites become complicated, which makes it possible to proceed gradually to more complex models. Such an approach made it possible to appraise critically the merits and drawbacks of the models in question and to come to specific conclusions about the advantages of one modeling method or another. Diverse stochastic and determinate models, which include an extensive set of factors which influence the characteristics of the increase of the need for new equipment, undergo analysis.

On the basis of the analysis the author infers the advisability of describing the process of producing new equipment by means of models of technological substitution. The name of the models of this class is connected with the most frequently encountered type of the dissemination of new equipment--new highly productive equipment is substituted in consumption for old equipment which is similar in functional purpose. Particular attention is devoted to the model of E. Mansfield, which includes two equations: the first one describes the process of substitution on the basis of a log curve, the second one describes the influence of socioeconomic factors on the parameter of the model which characterizes the speed of the process. The author analyzes in detail the results of the research on the improvement of this model. In conclusion he dwells on the problems, which arise in the process of work with models of technological substitution: the choice of the object and indicator of the forecast, the evaluation of the parameters and the checking of the statistical significance, the construction of confidence intervals.

In the fourth chapter "The Use of Models of Technological Substitution in the Management of the Production of New Equipment" the process of technological substitution in equipment and the forecast of the need for automated lubricating systems on the basis of the model of technological substitution and for the management of the production of automated lubricating systems on the basis of the forecast of the need are analyzed in detail.

The author discusses a specific example of the use of the model for the construction of a forecast of the need for lubricating equipment: technically imperfect types of lubricating equipment, for example, oil cans and pumps, which are used in case of manual lubrication, by automated systems. Such substitution is supported by the large economic impact of the automated systems--200-500 rubles per system. The model of E. Mansfield is chosen for the construction of the forecast. The author substantiates his choice by the simplicity of the evaluation of the parameters of the model and by the fact that all other models of technological substitution are merely modified versions of it. In the process of drawing up the forecast the model was also modified: the indicator of the economic impact was introduced, the factor of the capital-output ratio was eliminated as statistically insignificant.

The comparison of the model forecast with the forecasts, which were obtained in accordance with other methods, revealed a number of merits of the former. The forecast, which was constructed on the basis of the model of technological substitution, takes into account the dynamics of the impact and makes it possible to prevent the occurrence of a shortage of new products.

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ACADEMICIAN ON STRUCTURAL CONSTRAINTS ON SCIENTIFIC PROGRESS

PM241336 Moscow TRUD in Russian 12 Sep 85 p 2

[Interview with Academician V.A. Legasov by TRUD correspondents N. Korshunova, V. Korshunov, and V. Vostrukhin: "Priority of Science" -- date and place unspecified, first paragraph is editorial introduction]

[Text] Accelerating the rates of our society's socioeconomic development--that most important task was set the country by the CPSU Central Committee April (1985) plenum. The means of resolving it was also defined--utilizing the achievements of scientific and technical progress in the national economy in every possible way. But how is this to be done specifically? How must we organize everyday work in order to switch our economy onto the intensive path of development? This was considered in a conversation with TRUD correspondents by Academician Valeriy Alekseyevich Legasov, First Deputy Director of the I. V. Kurchatov Atomic Energy Institute, member of the USSR Academy of Sciences Presidium, and winner of the Lenin and USSR state prizes.

Question: Valeriy Alekseyevich, your initiative works in one of the priority sectors of science--nuclear power. It largely determines the further development of the national economy. Now that a fundamental restructuring of many technological and organizational systems--from science to production--is necessary it is apposite to ask you nuclear power workers the question "how is this to be done?"

Answer: The task is indeed difficult, but, on the whole, it is not a new one. In order to ensure the qualitative restructuring of sectors of the present-day economy and ensure the necessary rate of progress it is useful to turn to the historical experience amassed by our country in resolving the most important technical tasks. For instance, our institute was set up taking account of a number of most important principles. Where work is based on these principles there are always interesting and promising results and research, as a rule, ends in the creation of new technology and equipment. Where these signs are forgotten the work makes no progress and marks time.

Above all: when it is a question of adopting principled decisions and when it is necessary to create what has hitherto not existed, production must not dictate its conditions. Let us go back 40 or so years and remember under what conditions the atomic problem was resolved in our country. New materials were

needed to manufacture the first nuclear reactor: uranium and a neutron moderator--nuclear pure graphite containing millionths of parts of admixtures. At the time industry had no such materials nor any means of obtaining them. And if the scientists who were solving the atomic problem had been geared to existing industrial potential there simply would have been no success. But leadership of the problem was assigned to I. V. Kurchatov and his colleagues. That is--to science. It was given the right to decide what enterprises should be built, what institutes should be created for the relevant tasks, what preliminary results should be obtained in the laboratories, and what processes should be carried out directly at enterprises...

In other words, when it is necessary not to improve the old but to create something qualitatively new, the primacy of science over industry must be observed. Only in this way can the normal course of scientific and technical progress be ensured. Unfortunately, even now, after the CPSU Central Committee April (1985) plenum and the June conference on questions of accelerating scientific and technical progress many of us are restructuring our style of work extremely slowly. The prospects for accelerating scientific and technical progress are often determined not on the basis of scientific forecasting but on the basis of prevailing economic practice. I will cite an example from a field I know well--the power industry.

The power industry base needed for scientific and technical progress can only be ensured in two ways: building new power stations and oil and gas pipelines or saving power in the industrial production process. Today the second way is extremely important. However, implementing it is considerably more difficult than the first way, however paradoxical this may sound. New capacities are introduced by major units, everything is centralized, some member of government is bound to be in charge--in short, there is someone responsible. But energy savings must be made from every technological operation, every machine tool, every light bulb, and throughout the territory of the country. Who can be made responsible for this under current ecomomic practice? That is why energy savings are planned on an evolutionary basis--proceeding from the level that has been achieved.

Meanwhile the relative funds invested in energy production and energy saving must be determined by scientists--economists, power industry workers, and technologists. They alone are capable of defining economically advantageous ratios. Then it is necessary to ensure that the ministries carry out the scientific recommendations.

Is this rule being observed today, now? Alas no. You need only look at the energy-saving programs presented to the Gosplan by sector ministries.

Take aluminum production. To obtain 1 metric ton of the metal the leading foreign enterprises use around 6 metric tons of standard fuel. Ours use more than 7 metric tons. And the target is being set of reducing expenditure in 2-3 years to...the level achieved abroad right now. Of course, this is an inaccurate guideline. By the end of the century equipment will have been created that will make it possible to expend a considerably smaller quantity of fuel. That is why it would be more correct to create scientifically-substantiated technology with minimal energy consumption right now.

There is a similar situation with the use of natural gas for fertilizer production.

Why is it that what is being produced and prepared by science is not planned for? Because it is safe to retrace a path that has already been trodden! The scientific approach promises immeasurably greater advantages, but...new knowledge, new cooperation, and new technical means are required. And that is a "risky" business. Who, for instance, will build and produce these latest technical means?... That is why, as a rule, a more "reliable" scenario is chosen--gradual improvement. But ultimately it is unprofitable since it slows the rate of scientific and technical progress, increases the time taken to create qualitatively new equipment, and hinders the formation of new intersector links.

Question: It is hard to imagine more eloquent arguments in favor of the primacy of science. But what about the other "heavyweights"?...

Answer: I would term the second most important principle that of being strictly geared to end results. In observing this principle we obtain not only a clearly formulated target but also a form of work organization and even a reliable means of monitoring the efficiency of science. Let us return once again to the times of the atomic problem.

The structure of laboratories, departments and all industry was then shaped to meet the task that had been set. On the basis of this laboratories were set up with the necessary complements, hierarchies were formed, and salaries established--on the basis of the need to achieve the end result and of the scientist's contribution to the given specific matter. In current pra unfortunately, a structured organization is not created for the sake of resolving a certain problem, but, on the contrary, impersonal standard structures are proposed for all tasks. As a result concern about the divergence between an organization's structure and the problem it is resolving comes to the forefront, overshadowing the problem itself. I will illustrate this with an example.

In the prevailing situation there are standard institutes with standard laboratories, sections, and departments working in all sectors of the national economy. There should be 8-9 staffers in theoretical laboratories, 18 in experimental laboratories, 50 in departments, and so forth. The order created by this structure is an illusion. For instance, a laboratory is needed to monitor a certain type of nuclear power station. The Ignalina AES has a laboratory and the Zaporozhye AES has another. Yet the laboratory working on the problem of the diagnostic checking of nuclear power stations, which needs to create a large number of new instruments and collate a vast amount of information, is short of 50 people. That is why it is necessary to entrust individual leaders with determining the structure of their institutes and the personnel complements of laboratories and subunits. And results must be the criterion of work and the main factor in monitoring. If end results are achieved, that means people are working well. If not, they are working badly. In my opinion, the system of regulatory formal indicators which restricts leaders on all sides arose from an inability to competently assess the scientific and technical level of an enterprise and the economic efficiency

of its activity. Ersatz monitoring arose, for the sake of which average personnel complements, average salaries, and average numbers of administrative and managerial personnel were created and structural uniformity was introduced.

There is yet another important principle closely linked with the orientation toward end results. In resolving problems it is necessary to rely on specialists who are the most competent in their field. I stress--not just knowledgeable ones! When our institute was set up Igor Vasilyevich Kurchatov's instruction was to select on an individual basis people who through their personal qualities were capable of resolving the prescribed tasks.

Question: Is it possible in our day and age, when scientific collectives run to 500, 1,000, and sometimes more people to handpick specialists, even beginning with the group leader?

Answer: Of course it is. And it's not as hard as it seems. The sea of science is boundless and there are many scientists, but specialists in each specific field are well aware of one another. Every intelligent person stands out. Staff vacancies for resolving a problem must be filled not just by specialists but by the specialists best able to resolve the task in question. If we sometimes forget this there is just one reason. Scientific institutions are not geared to achieving end results. Their work is not assessed by its efficiency but by some kind of philosophical parameters.

Question: But what can be considered end results for fundamental scie-- where negative results are sometimes extremely important?

Answer: The growth of the country's intellectual potential. This seemingly abstract indicator is fully open to precise assessment. In general the division of science into fundamental and applied is purely relative. In the prewar years in this country two main avenues existed: fundamental research in various scientific fields not limited by time, and specific applied developments in a determined period of time. The need to rapidly create nuclear weapons in response to the U.S. nuclear blackmail caused the synthesis of these two avenues. The leaders of fundamental science were not just geared to specific research results but worked the tight schedules. That is, they did not just resolve a task but resolved it within a certain timescale. Shortage of time is a most important mobilizing factor. That is why any task must be set taking account of this factor and any collective must after a certain time change its topic of study regardless of whether it has been successfully resolved or not. Even if it is clear beforehand that the problem is a tough one and requires a long time this just means that several of the "teams" resolving it will have to be changed. Otherwise large scientific collectives may be out of touch with the most important present-day scientific problems. Because they are stubbornly involved with the very same topics which were begun some time ago and have lost their urgency over the years.

Question: Valeriy Alekseyevich, when speaking of the effectiveness of the principles on which your institute's work is based you constantly refer to the nuclear problem. Which, needless to say, is correct. And yet, you will agree,

that was an exceptional case. Do you have sufficient examples of the successful application of these principles for creative purposes?

Answer: The institute's entire postwar history can serve as such an example. After resolving the nuclear problem the institute proposed the world's first nuclear power station, the world's first nuclear-powered icebreaker.

One other example--the institute's work on studying substances using the methods of nuclear physics. The fact is that with the help of the streams of neutrons, protons, and electrons that are created in reactors and accelerators it is possible to distinguish very small concentrations of various elements in substances. The first year after we offered our services the atomic energy institute received orders for 600,000 element identifications. Moreover, all further progress in fields such as agrochemistry, biotechnology, medicine, electronics, and materials technology is inevitably linked with increasing the precision of the identification of various trace elements.

Thus, having, as it were, a lead in the work in research into substances using the methods of nuclear physics, we have been able to respond to the national economy's needs immediately, as soon as they arise. And had the techniques and methodology of the analysis of substances not been worked out beforehand (that is, in good time!) the major avenues of scientific and technical progress could not have developed without being delayed.

This is the main role of science in scientific and technical progress--creating the necessary headstart. And in order to implement the results of this leading research it is important to trust science--not in words but in deeds. And to plan the further development of industry not "from the level that has been achieved" but on the basis of scientific recommendations. By traveling this road our country has already repeatedly scored outstanding successes.

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ORGANIZATION, PLANNING AND COORDINATION

ECONOMIC PROBLEMS OF SCIENTIFIC-TECHNICAL PROGRESS

Moscow EKONOMICHESKIYE PROBLEMY NAUCHNO-TEKHNICHESKOGO PROGRESSA in Russian 1984 (signed to press 28 Dec 83) Chapter 3 pp 78-108

[Chapter 3, "Forecasting and Planning Development of Science and Technology," from Educatioal Aid for Workers of NII [Scientfic Research Institutes] and KB [Design Bureaus]: "Economic Problems of Scientific-Technical Progress," 3rd edition, revised and expanded by G.A. Krayukhina, Izdatelstvo "Ekonomika," 50,000 copies, 296 pages]

[Text] 1. The State Planning System for Developing Science and Technology.

Party and Government Measures for Improving Planning of Scientific-Technical Progress.

Centralized planning in developing science and technology in the USSR is the most important condition for implementing scientific-technical policy in the national economy of the USSR.

Plans for scientific research and development are a component part of the state system of planning economic and social development of the country. They are prepared in mutual coordination with other elements of the national economic complex and ensure constant renovation of production and promotion of its scientific and technical-economic level.

Planning of scientific and technical development is carried out within the framework of goal-directed management of scientific-technical progress. In content this management also includes forecasting development of science and technology, forming organizational and management structures in the sphere of science, a system for collecting and processing scientific-technical and economic information, controlling fulfillment of plan tasks and appraising and analyzing the activity results of all links of science and technology. The enumerated elements are the most important functions in the management of scientific-technical progress. Their implementation presupposes utilization of economic, organizational-planning and social-psychological methods.

A central place in the management of scientific-technical progress is occupied by planning of scientific and technical development. The leading role of planning in the management of scientific-technical progress is determined by the fact that selection and substantiation of long-range development goals, which reflect the final national economic results, is carried out during the drawing up of plans for the development of science and technology. During

planning, the subject matter is determined, programs for scientific research and development are formed, the resources required for their fulfillment are appraised and the executors of work and periods for conducting it are fixed. The allocated resources for fulfillment of research and developments are distributed among work executors.

The basic principles of planned supervision of scientific-technical progress under socialism were formulated by V. I. Lenin on the basis of theoretical positions of K. Marx and F. Engels on the role of science and technology in society. The "Outline of a Scientific-Technical Work Plan," which was prepared by V. I. Lenin, was the first program document of socialist transformation of the country's economy on the basis of scientific-technical progress. V. I. Lenin's ideas on planned development of Soviet science and technology have found concrete embodiment in the first plan of the socialist state--the long-term plan for power reequipment of the country--the GOELRO [State Commission for the Electrification of Russia] plan.

Creative development of V. I. Lenin's lofty legacy has made it possible to create a system for planning scientific-technical progress in the Soviet Union. During a period of more than 50 years since the adoption of the first five-year plan, our country has accumulated enormous, unique experience in many respects of planned development of the national economy, which is being continuously enriched. Further improvement of the entire planning system is underway.

The need to improve planning of scientific-technical progress in all links of the national economy was noted at the 24th, 25th and 26th CPSU Congresses and the November (1982) plenum of the CPSU Central Committee. "We have great reserves in the national economy...," Yu. V. Andropov said. "These reserves should be sought in speeding up scientific-technical progress and in the extensive and swift introduction in production of scientific and technological achievements and advanced experience... The methods of planning and the system of material incentives must promote the alliance of science and production." [1]

The most important features of the measures being conducted by the Communist Party and the Soviet government for improving supervision of scientific-technical progress are consistent realization and development of Leninist teaching and the principles of reequipment of the socialist national economy, which were worked out by V. I. Lenin. Proceeding from the Leninist demands on management of the planned economy, the party regards the process of improving planning of scientific-technical progress as constant activity and strives for continuity of all its stages and their coordination with specific conditions of communist construction in the country. In this case special attention is devoted to strengthening the role of state centralized planning of scientific-technical progress measures, using the principles of democratic centralism in supervision of scientific and technical progress, extensive generalization and dissemination in sectors of the national economy of leading experience in speeding up scientific-technical progress of the USSR and other socialist countries and disseminating in every possible way the latest achievements of theory and practice in management of the socialist economy.

Improvement of planning, like the entire system of supervision of scientific-technical progress, is carried out on the basis of taking into account the historic experience as well as the systems scientific analysis of specific conditions and arising problems in the development of economy.

Planning of scientific-technical progress is improved with the development of the entire socialist economy and its individual elements. An increase in the scale of scientific-technical activity, complication of the very objects of new technology and acceleration in the rate of production renovation in sectors of industry--these and some other factors lead to complication of tasks in supervising scientific-technical progress, including planning scientific developments and research. Scientific-technical progress under conditions of mature socialism, which includes all links of social production and distribution, requires utilization of adequate and constantly developing planning forms and methods.

An important stage in improving planning of scientific-technical progress was the resolution of the CPSU Central Committee and the USSR Council of Ministers on improvement of the economic mechanism and development of corresponding methodical directions, positions and instructions.

The provided system of measures is aimed at coordinated raising of the planning work level in all links of the national economic complex and strengthening of the stimulating functions of scientific-technical progress in sectors of industry.

The main task in improving planned supervision of the national economy, including development of science and technology, consists in organic linking in practice the advantages of our socialist system with the achievements of our socialist system for the purpose of fullest satisfaction of social requirements. A leading role in solving this task is alloted to improvement of the state system for planning the development of science and technology.

Improvement of the national economic planning in development of science and technolgoy in the 11th Five-Year Plan will be carried according to four basic directions:

further expansion of scale in long-term planning of development of science and technology;

strengthening special-purpose direction of scientific-technical development plans;

raising the comprehensive nature in planning scientific-technical work and the scientific substantiation of prepared plans by reorganizing the system of plan indicators as well as indicators appraising the functioning efficiency of scientific research institutes, design bureaus, associations and ministries; and

ensuring continuity and succession in the formation of plans for science and technology of different duration and various level.

Improvement of the system of plan indicators contributes to raising the comprehensive nature in planning scientific-technical work and the scientific substantiation of plans. In plans for development of science and technology it is envisaged to reflect more extensively the indicators which take into account the final results in implementing programs for research and development. Among them are the economic effect from conducting scientific-technical measures, indicators for raising the technical level of production and the most important kinds of manufactured goods, reduction of commodity production costs, increase of labor productivity in industry, increase of labor mechanization and automation by virtue of scientific-technical measures and others.

It is envisaged to raise the comprehensive nature in planning scientific-technical work by virtue of more extensive utilization in management of scientific-technical progress of special-purpose programmed methods and development at all levels of management of special-purpose comprehensive scientific-technical programs and programs for solving most important scientific-technical problems.

For the purpose of continuity and succession of processes in planning the development of science and technology a strict order will be adhered to in the development and coordination of plans at different levels of supervision. Special significance in solving this task is attached to preparation of basic directions of economic and social development of the USSR as well as to substantiation of control figures for basic indicators and economic norms, which are fixed for 5-year periods. The development of basic directions of economic and social development of the USSR for 10 years and confirmation for every five-year plan of control figures for most important indicators make it possible to reflect more fully the achievements of science and technology in the plans being developed.

Improvement of planning supervision of scientific-technical progress, which is provided for in resolutions of the Communist Party and the Soviet government, is oriented toward further development of cost accounting and strengthening the role of economic levers and stimuli in the sphere of science and technology. Only such an approach can make it possible to ensure efficient combination of centralized planning supervision of scientific and technical development with broad economic initiative and scientific and technical independence of individual scientific research institutes and design bureaus. The resolution on improving the economic mechanism provides for completion of conversion of an overwhelming majority of sectorial scientific research institutes and design bureaus to new planning and economic stimulation conditions; introduction of financing of scientific research institutes and design bureaus on the basis of payment for fully completed work which was accepted by a client and the order of formation and utilization of a unified science and technology development fund; and regulation of the order of formation and utilization in scientific research institutes and design bureaus of economic incentive funds.

Realization of the broad complex of measures for improving planning of scientific-technical progress, which was outlined by the Communist Party and the Soviet government, ensures a realistic increase of effectivness of the research and development programs being fulfilled and contributes to fulfillment of the 11th Five-Year Plan tasks.

Comprehensive Program of Scientific-Technical Progress for the Long Term

The consistent improvement in planned management of the national economy, which is carried out by the Communist Party and the Soviet government, is directed at fuller disclosure of advantages of the socialist production system under contemporary conditions. One of such advantages lies in the possibility of formation and consistent implementation in the USSR of a unified state scientific-technical policy. A unified state scientific-technical policy is realized in the form of an aggregate of unified principles, methodological bases and a system of planned management of scientific-technical progress in all spheres and links of the national economy. The formation of a correlated system of basic directions and measures and indicators of scientific-technical progress, which are oriented toward solving specific tasks of economic and social development of the USSR, are realized within the framework of a unified state scientific-technical policy. During various stages of the historic development of the USSR, the state scientific-technical policy changed both in form and content.

Under contemporary conditions, the Comprehensive Program of Scientific-Technical Progress for 20 Years may be regarded as the most important form that expresses a unified state scientific-technical policy and as an instrument of its formation.

The development of the program was organized by the USSR Academy of Sciences, the USSR State Committee for Science and Technology and the USSR Gosstroy [State Committee for Construction] with participation of the USSR Gosplan [State Planning Committee] and covers a 20-year period. Forecasting and analytical work, which has no analogies in world practice and which made it possible to form the Comprehensive Program of Scientific-Technical Progress to the year 2000, was completed in the USSR in 1979.

Participating in the development of the program were 27 special commissions on individual directions of scientific-technical progress, which united about 2,000 scientists and specialists of various scientific research institutes, design bureaus, industrial enterprises and associations as well as VUZs of the country.

The Comprehensive Program of Scientific-Technical Progress to the year 2000 establishes basic proportions in the development of our country's science and technology, defines the most important scientific-technical problems and ways for solving them and reveals the expected results of putting scientific and technical achievements into effect in the national economy. The development of such program creates a unified basis for coordinated preparation of all types and divisions of national economic plans. It establishes national economic reference points, which determine the final national economic results for 20 years, without knowing which it is impossible to supervise the economy successfully.

Among the most important reference points of the Comprehensive Program of Scientific-Technical Progress to the year 2000, which determine the basic correlations in the "science--technology--production" system, are the proportions:

between science, technology and production, which determine correlations of the rates of development of every element of the system;

within science, which establish correlations of the rates of development of fundamental, exploratory and applied research and planning and design developments as well as correlations of the rates of development of individual scientific directions;

in technology, which determine correlations of the level of its development and the degree of satisfying the requirements of the national economy in various means of labor, advanced technologies and materials; and

in production, which characterize the structure of future production and its scale as well as its change under the influence of scientific -technical progress.

Work on the Comprehensive Program of Scientific-Technical Progress to the year 2000 is not limited to one-time calculations, but is carried out periodically. It was established that necessary clarifications must be made in the program after every 5 years and that it must be extended for a new 5-year period.

The Comprehensive Program of Scientific-Technical Progress includes all spheres of the national economy, in which achievements of science and technology are materialized. In mutual coordination it provides for prospects of equipping with new technology the sectors of physical production, the nonproductive sphere and the sphere of scientific research and development itself. Taking into account the features of a specific stage of communist construction in the country, the comprehensive program establishes principal directions of scientific and technical development in each sphere and volumes and methods of concentrating necessary resources for this as well as expected results and methods of using them in the national economy.

Along with specific economic tasks, which are connected with raising the efficiency of social production, the program provides for the solution of major social problems, such as improvement of labor conditions, mechanization and automation of production processes, reduction of manual and hard physical labor and overcoming substantial differences between mental and physical labor and between city and village. Measures are provided in the field of development of housing construction and architecture, public health and public education.

A special place in the Comprehensive Program of Scientific-Technical Progress is devoted to problems of environmental protection and to considerate and efficient use of the country's natural riches and its raw material resources.

The development and realization of the Comprehensive Program of Scientific-Technical Progress to the year 2000 is a new step in improving long-term planning methods for the development of the national economy. The comprehensive program's data serves as a basis for the development of all kinds of plans for the development of science and technology.

Composition, Content and Order for Working Out State Plans for Development of Science and Technology

Planning the development of science and technology is the most important link of the state management system of scientific-technical progress. This system includes the development of plans in the field of science and technology, which are drawn up at all management levels and differ in the period of action, content and the degree of elaboration of assignments.

Depending on the management level, plans are subdivided into state, republic (regional), ministry (sectorial) and plans of scientific research and planning and design organizations, enterprises and associations, their subdivisions and individual executors.

A central place is occupied by state plans for the development of science and technology. They are developed as parts of long-term and annual state plans for economic and social development of the USSR. Plans for the development of science and technology at the national economic level contain assignments with regard to solving most important scientific-technical problems. They include major special-purpose comprehensive scientific-technical programs and programs with regard to solving most important scientific-technical problems, assignments in mastering output of new production and introducing advanced technology and so forth. Plans for the development of science and technology, which are developed at the national economic level, are the basic instrument for ensuring a unified state scientific-technical policy of the USSR.

A distinctive feature of the contemporary stage is strengthening of development, along with sectorial, of regional aspects in management of scientific-technical progress. Becoming one of the main ones is the principle of efficient combination and harmonious interaction of sectorial and territorial planning of scientific and technical development. The basis of combination of these kinds of planning is the objective delimitation of functions and content of sectorial and territorial plans of scientific-technical progress and their continuity.

Sectorial scientific and technical development plans ensure implementation of a unified scientific-technical policy in a sector, establish basic directions in the development of science and technology, reveal most important problems and ways for solving them and determine volumes of scientific research and development and expected results of their utilization in the national economy. Sectorial plans are the initial ones for territorial calculations.

Territorial planning, relying on sectorial planning, deepens the planning process of scientific-technical progress in individual regions. The main tasks in territorial planning of scientific and technical development consist in ensuring sound and balanced development; distributing and using a region's scientific-technical potential and coordinating here the scientific-technical activity of various sectors; revealing and determining ways for solving regional intersectorial scientific-technical problems, which are connected with the organization in it of intersectorial production; implementing nature protection measures; comprehensively using the raw materials base; solving a region's social problems; and so forth.

The planning system for development of science and technology in the USSR provides for development of long-term (for a period of 20 years), medium-term (5-year) and short-term (annual) plans.

Long-term prospects for the development of science and technology and the possibilities connected with it of economic and social development of the national economy of the USSR are reflected in the Comprehensive Program of Scientific-Technical Progress.

Based on the Comprehensive Program of Scientific-Technical Progress to the year 2000 as well as proceeding from the socioeconomic tasks, which were determined by the Communist Party for the long-term, the USSR Gosplan together with ministries and departments of the USSR and councils of ministers of union republics is working out a draft of the Basic Directions of Economic and Social Development of the USSR for 10 years (by 5-year periods).

The basic directions for development of the national economy generalize the practice of communist construction in the USSR and other socialist countries, sum up the results of the national economy's development during the past five-year plan, determine the tasks of economic and social development for a 10-year period and outline a system of measures for their realization.

The 26th CPSU Congress confirmed the Basic Directions for Economic and Social Development of the USSR for 1981-85 and the period up to 1990. An independent section (III) of the Basic Directions formulates the tasks with regard to development of science and acceleration of technical progress in the national economy. For the first time since the Leninist plan of the State Commission for the Electrification of Russia, the Basic Directions that were adopted by the 26th CPSU Congress include not only the regular 11th Five-Year Plan but also a much longer term--the entire eighties.

The Basic Directions of Economic and Social Development of the USSR serve as a basis for the development by the USSR Gosplan of control figures for basic indicators and economic norms for the forthcoming five-year plan. The development of control figures was included in a unified order of drawing up long-term plans for the country's economic and social development. It makes it possible to deepen the preplanning preparation of five-year plan tasks and to thoroughly study and take into account in them the expected results of scientific and technical development. The control figures for the 11th Five-Year Plan begin with a section on the development of science and technology. It provides for tasks with regard to raising the technical level of production and most important kinds of manufactured production, which are differentiated according to sectors of industry and the national economy. Control figures are a basis for planning specific measures and for forming long-range subjects of scientific research and development in five-year plans. The introduction of control figures into planning practice ensures realization of an effective form in fulfilling plans for the development of science and technology on the basis of combining the tasks "from above" and the planned projects being prepared "from below."

The basic form of state planning of science and technology are five-year and current (annual) plans. The state five-year plan for the development of

science and technology is developed as a component part (section I) of the plan for economic and social development of the USSR,[1] proceeding from long-term prospects, adopted basic directions of scientific and technical development, the Comprehensive Program of Scientific-Technical Progress to the year 2000 and proposals of the USSR State Committee for Science and Technology, ministries (departments) of the USSR and councils of ministers of union republics.

Indicators and measures, which encompass all stages in developing and mastering new technology, are reflected in the state plan for development of science and technology. It provides for the following sections:

scientific-technical programs;

mastering output of new kinds of industrial production;

introduction of advanced technology, mechanization and automation of production processes;

sale of Soviet commercial licenses abroad, purchase of foreign licenses and models of new articles and using them in the national economy of the USSR;

state standardization;

introduction of scientific organization of labor (NOT);

basic indicators of the technical level of production and most important kinds of manufactured production;

economic effect from carrying out scientific-technical measures;

financing of scientific research work;

training of scientific and scientific-pedagogical personnel through postgraduate courses; and

basic tasks with regard to scientific-technical problems, which are developed in cooperation with foreign countries.

The development of state five-year plans is preceded by thorough analytical work in studying the most advanced directions in the development of science and technology. Determined in the process are the main tasks of scientific-technical progress and the planned technical level of production as well as most important scientific research and development for establishing a scientific-technical reserve. Moreover, the condition of research and the achieved level of development in corresponding branches of science and technology in the USSR as well as abroad are taken into account. Particular attention is devoted to selection of most promising directions of technical progress that ensure an increase in the technical level of production of those sectors which determine the acceleration of technical progress of the national economy as a whole.

Tasks with regard to fulfillment of scientific-technical programs represent the most important part of the state five-year plan for development of science and technology. A five-year plan provides for two kinds of programs:

special-purpose comprehensive scientific-technical programs, which are developed for realization of the most significant scientific-technical achievements, the use of which ensures in the near future a substantial rise in production efficiency and quality of production; and

programs for solving most important scientific-technical problems, which are of national economic significance and are linked with the development of fundamentally new kinds of equipment and technology.

The list of basic scientific-technical programs, which are subject to inclusion in the national economic plan, is established during the stage of formation of the Basic Directions of Economic and Social Development of the USSR. This list includes complex intersectorial tasks, which define the technical policy in sectors and are of important national economic significance. Among the most important scientific-technical problems being solved during the current five-year plan are the provisions for establishing a combination of equipment for materials handling, loading and unloading and warehouse work, combinations and systems of machines for mechanization and automation of production processes, further development of power engineering and environmental protection and others.

For each problem a list of most important tasks is established in which the content of a given problem is fully revealed and what is to be developed and prepared for practical use in the national economy is shown.

The plans particularly point out as to which tasks it is planned to fulfill with the participation of CEMA-member countries, and also take into account the pruchase of licenses for technological processes and equipment.

The following are established for each task: most important technical and economic indicators of new kinds of production and technological processes being developed; periods for fulfillment of tasks and volumes of work; ministries and departments, which are responsible for their fulfillment; and ministries, departments, organizations and enterprises, which are participating in fulfilling these tasks.

For the purpose of ensuring correct organization and mutual coordination of executors, for each task in comprehensive program a provision is made for stage-by-stage fulfillment of the entire complex of work--from research to mastering new equipment in series production.

Simultaneously with preparation of scientific-technical programs, the USSR Gosplan is organizing development of specific tasks and measures for mastering production in the national economy of new kinds of industrial production, utilization of advanced technology, mechanization and automation of production processes, state standardization of production and basic indicators of the technical level of output and production.

Only basic tasks and measures, which are of important significance for the development of the national economy as a whole, are confirmed in the state plan.

Calculating the future economic effectiveness of using the expected results in the national economy supports the inclusion in the state plan for developing science and technology of every problem,task and measure.

A special place in the plan for the development of science and technology of the 11th Five-Year Plan is occupied by tasks for basic indicators of the technical level of production and manufactured output. The following indicators are established among those planned:

for production of highest category of quality (products list, relative share and volume of production);

for production of second category of quality (products list, relative share and volume of production);

for production which is obsolete and is being dropped from production (type sizes, kinds, descriptions and relative share in the overall quantity of type sizes, kinds and descriptions of manufactured production);

for production which is being mastered for the first time in the USSR (type sizes, kinds, descriptions and relative share in the overall quantity of type sizes, kinds and descriptions of manufactured production);

for production which is produced during the period up to 3 years inclusive (type sizes, kinds, descriptions and relative share in the overall quantity of type sizes, kinds and descriptions of manufactured production);

degree of labor mechanization and automation (relative share of workers who are performing work by the mechanized and automated method in the overall number of workers);

absolute reduction of the number of workers who are engaged in manual labor (in thousands of people) and the relative share in the overall number of workers who are engaged in manual labor in corresponding production;

reduction of production costs through measures which raise the technical level of production (in millions of rubles); and

increase of labor productivity by virtue of raising the technical level of production (in percent).

Along with these generalizing indicators, specific ones, which reflect particular features of sectors and types of production, are developed during the drawing up of five-year plans.

In essence the tasks established in this section reflect the final results of planned measures for the development of scientific research and utilization of scientific and technical achievements in the national economy.

One of the features of the plan for the development of science and technology of the 11th Five-Year Plan consists in the fact that it provides for planning of the economic effect from carrying out scientific-technical measures.

Annual plans for the development of science and technology are worked out on the basis of tasks and economic norms of a five-year plan for a corresponding year. They provide for the necessary precise definition of measures as well as of five-year plan indicators with regard to periods, scale, composition of executors and fulfillment conditions. Unlike a five-year plan, the drawing up of annual plans begins "from below"--in individual associations, at enterprises and in scientific research institutes and design bureaus.

Participating in their development are collectives of scientific institutions, which put forward resourceful proposals and counterplans aimed at most rapid completion of five-year plan tasks.

An annual state plan for the development of science and technology includes the same types of tasks as a five-year plan.

Fulfillment of state plan tasks is ensured through a system of sectorial and republic five-year and annual plans for the development of science and technology. These plans provide for tasks that are a result of government resolutions, state plans and programs, sectorial scientific-technical forecasts and forecasts of regional development and proposals of organizations, industrial enterprises and associations.

The structure of five-year and annual plans for the development of science and technology of union republics and ministries of the USSR is similar to the structure of state plans.

Territorial Aspect in Management of Scientific-Technical Progress

The necessity of territorial management of scientific-technical progress is due to:

first of all, the increased scale of social production and the difficulties in coordinating at a national level of work being fulfilled by scientific-technical organizations of the country. Experience proves that at a national level it is possible to successfully plan and control the realization of the most major programs, which are of intersectorial and strategic significance. At the same time, many regions, first of all major cities, have a scientific-technical potential which can be used more fully for territorial development of productive forces. Therefore, along with improvement in centralized management of scientific-technical progress there is a need for improving territorial management. It is a question of comprehensive coordination of the vertical and horizontal planning systems and bringing scientific-technical developments to consumers regardless of departments in which they were fulfilled;

second, the necessity of comprehensive inclusion in research of national economic problems and introduction of scientific and technical achievements not only at the level of the country and sectors, but also at the level of territorial socioeconomic systems, particularly those that are being newly formed. Among the territorial scientific-technical problems are the comprehensive development of natural resources and environmental protection; formation of territorial scientific-technical and production complexes on the latest

scientific-technical basis; solution of urban development and social welfare tasks; establishment of territorial ASU [automated control systems]; and so forth. Territorial systems (krays, oblasts, cities), particularly those where enterprises and scientific institutions are concentrated, can become testing grounds for comprehensive utilization of scientific-technical achievements. The comprehensive nature of research in these systems will make it possible in the future to disseminate the obtained results to sectors and other territorial systems; and

third, the increased role of the human factor in acceleration of scientific-technical progress and strengthening of the democratic principles in managing it.

Improvement of territorial management of scientific-technical progress is carried out in close combination with sectorial in two basic directions. On the one hand, the leading experience in fulfilling and introducing scientific-technical developments, which are planned by ministries and departments, is being disseminated. On the other hand, the advantageous horizontal scientific-technical ties, which form territorial scientific-production complexes, are developed and maintained. A positive experience has already been accumulated in the realization of the first direction with direct participation of local party and soviet organs. As a result of organizational work of the aforementioned organs, many scientific and technical achievements got a start in the national economy. The second direction requires further study and solution of comprehensive national economic development problems in regions, analysis of their scientific-technical potential, improvement of its structure, development and realization of regional programs of scientific-technical progress and improvement of methods and organizational forms of their territorial management.

A study of the scientific-technical potential in regions makes it possible to make a conclusion that the territorial structure which has developed often does not correspond to the requirements of their economic and social development and that the possibilities of territorial cooperation of academic, VUZ and sectorial science, its technical base and organization of the "science--technology--production" process are not being used. Interdepartmental cooperation in the sphere of science is still limited in regions. Often scientific research institutes, which are concentrated in one city, carry out research on the same subjects and fulfill work not for neighboring but remote regions. For example, Novosibirsk enterprises receive NOT [scientific labor organization] plans for multiple skills of turner, metalworker and milling machine operator from Kiev, Leningrad, Tbilisi and Tula. At the same time, some local organizations are developing similar plans for other oblasts.

During the past few years, a greater tendency has been observed toward territorial concentration of science and its integration with production. Many large cities have been transformed into scientific-technical and production complexes. Organization of introduction must come forward as their important links.

A complex of sectorial design bureaus and institutes with experimental production--a so-called "introduction belt" around the Novosibirsk Akademgorodok--

has become one of such links of the introduction chain. Today, thousands of associates are working here, including doctors and candidates of sciences. Academic institutes turn over their developments and proposals on improving production to scientific research institutes and design bureaus of the "introduction belt." There they undergo production perfection of technological processes and first batches of models and technical documentation for transfer to industry are prepared.

Broad scientific cooperation, exchange of highly skilled personnel and constant influx in the national economy sectors of research results which were just obtained by large-scale science--this is the source of strength of the "introduction belt," this makes it a connecting link between science and production. Experience has confirmed that the organizations of ministries and departments which cooperated more closely and creatively with the Siberian Department of the USSR Academy of Sciences have achieved most serious successes. For example, the Siberian Special Design Bureau of the Neftegeofizika Scientific-Production Association by using achievements of the Geology and Geophysics Institute and the Automation and Electrometry Institute of the SO [Siberian Department] of the USSR Academy of Sciences and the Siberian Scientific Research Institute of Geology, Geophysics and Mineral Raw Materials of the USSR Ministry of Geology has firmly occupied advanced positions in the field of developing latest geophysical equipment. The equipment developed by this collective has substantially expanded the possibilities of regional seismic prospecting. These possibilities are being used in many production and scientific research organizations of the country. Introduction of one type of portable seismic remote control station alone has made it possible to obtain an economic effect which is measured in tens of millions of rubles. The economic effect from all work performed by organizations of the "introduction belt" in the past 10 years exceeds R250 million.

Much has been done to solve the afrementioned problems in Leningrad, Tomsk, Lvov, Minsk, Moscow, Novosibirsk, Sverdlovsk and other oblasts. Successful forms of cooperation of science with production have been established in these oblasts. For example, regional research and introduction programs on the basis of agreements on scientific-technical cooperation and economic agreements, intersectorial laboratories and integrated brigades of scientists and production workers. A considerable rise in the scientific-technical level of personnel and production should be regarded as the most important result of science's influence here. Almost the entire increase in volumes of production is being achieved by virtue of increased labor productivity. Territorial cooperation does not disrupt intrasectorial ties, but, on the contrary, enriches them. Sectors receive an additional channel of communication with science, and science gets an outlet to a sector. In the process it is important to consistently eliminate duplication of scientific-technical work by determining leading organizations for most important directions, thereby making it possible to increase volumes of work and to release personnel to solve new tasks, including for a territory where scientific research institutes, VUZ's and planning and design organizations are located.

In accordance with the resolution of the CPSU Central Committee and the USSR Council of Ministers "On Measures for Accelerating Scientific-Technical Progress

in the National Economy," territorial scientific-technical programs will be developed beginning in the 12th Five-Year Plan, and their basic tasks must be included in five-year and annual plans.

Further deepening and expansion of territorial integration of science and production requires considerable strengthening of organizational and economic principles in management and intensification of ideological training work. In the territorial system of management, the solution of these tasks is assigned most often to public organizations--councils for promotion of scientific-technical and socioeconomic development, which operate under the supervision of party committees. Forming a part of them are supervisors, scientists and specialists --representatives of most varied departments and party, soviet, trade union and Komsomol organs. The main task of councils is accelerating scientific-technical progress on the basis of developing ties between scientists and production workers. Council sections, which are organized according to problem directions, (for example, in Leningrad, Lvov, Novosibirsk and Sverdlovsk)) have an opportunity to associate directly, exchange information on problems and achievements and form scientific-technical programs and collectives of executors. The work of a section is coordinated by the council presidium. Proposals on most important questions are submitted to buros and plenums of CPSU obkoms and gorkoms.

Comprehensive plans for economic and social development of individual regions, cities and territorial-production complexes, which are included as special sections of the program for scientific-technical development, have become an effective form of coordination of sectorial and territorial planning.

The Economic and Social Development Council of the Leningrad CPSU Obkom, the City Planning Commission and the Interdepartmental Coordination Council of the USSR Academy of Sciences in Leningrad have initiated the development of a regional comprehensive program of scientific-technical progress. They have accumulated useful experience.

In 1979, the Novosibirsk CPSU Obkom together with scientific organizations studied the subject matter of developments being fulfilled by scientific research institutes, design bureaus and VUZ's in Novosibirsk and discovered that these developments make it possible to implement some special-purpose programs of intersectorial nature. As a result, more than 20 programs were formed: "Labor and Labor Resources," "Health of the Population," "Robotization of Industry," "Effectiveness of Using a Park of Machines with ChPU [numerical programmed control]," "Cumputer-Aided Design," "Powder Metallurgy," "Construction," "Reliability of Power Network Operation," "Introduction of ASU [automated control system]," "Optimization of Transportation System Development" and others.[3]

The work developed under the supervision of the Council for the Promotion of Scientific-Technical and Socioeconomic Development of the Novosibirsk CPSU Obkom has made it possible to approach in a comprehensive manner the problem of integration of science with production and to form a certain system, which was named "Science--Production--Effectiveness." This interaction of science with production is based, first of all, on bilateral economic agreements. In 1976-81 alone, scientific research institutes of the Novosibirsk Scientific

Center and city VUZ's performed work for the oblast valued at R150 million.[4] The average economic effectiveness of developments was R3.5 per R1 of expenditures.

The work experience of the Lvov Oblast party organization in strengthening ties of science with production and in raising production quality is interesting. VUZ science is developed well enough in Lvov as in other cities. Until recently, Lvov scientific forces were isolated. Their unification was promoted by the establishment of the Western Scientific Center of the UkSSR Academy of Sciences. On the initiative of the obkom, the ZNTs [Western Scientific Center] of the UkSSR Academy of Sciences became a coordinating organ for development and realization at enterprises of some important scientific-technical programs. In the beginning a list of problems that require comprehensive scientific study was compiled, executors were then determined and necessary coordination of work was carried out. Thus, a specific scientific-technical program became the basis of an organization of specialists of various branches of science (interdepartmental scientific-production association). The activity of these associations is regulated by multilateral and general agreements on cooperation and regulations, which were confirmed by ministries and departments, as well as by a decision of the Lvov Obkom. The overall supervision of such an association is carried out by a scientific-technical council. In 1980, 17 interdepartmental special-purpose scientific-production associations of various sectors were functioning in the Western Scientific Center of the UkSSR Academy of Sciences, which for their part were unified into four scientific-production complexes. Participation in such territorial organization does not disrupt the departmental system, but only expands the sphere of the latter's activity and enriches it. The basic result of cooperation within the framework of a scientific-production association is formation in the process of working together on realization of a specific program of stable collectives of scientists and production workers of various scientific-technical directions who are united by a common goal. Thus, the principle of an "integral chain" from a scientific idea to its practical introduction in production is being realized. In 1979 complexes and associations completed 41 developments with an economic effect of R41.4 million. In particular, methods of induction heat treatment of high-strength drill pipes and the necessary set of equipment were developed for the first time in world practice. Introduction of the development has made it possible to shorten the period for organization of pipe production by 7 years, to reduce capital investments by R7.5 million and the effect from introduction amounted to R20 million.

A certain experience in territorial supervision of economic and cultural construction with the aid of special-purpose scientific-technical programs has been accumulated in Chelyabinsk. These programs coordinate activities of subdivisions of various departments with regard to efficient use of many kinds of raw materials, metals and fuel and mechanization of hard manual labor. The "Metal" program is aimed at cultivating careful, economical attitude toward metal, raising its quality, reducing metal content of machines and replacing metal cutting technology with low waste processes. Work on the program is headed by the oblast party organization. Participating actively in its realization are scientists and production workers, who are combined in comprehensive creative brigades. A durable chain has appeared: institute--metallurgic plant--machine building enterprise. During the years of the 10th Five-Year Plan, the oblast saved 1.15 million t of ferrous metals and achieved certain successes in economizing living labor.

Much work in organization and realization of regional scientific-technical programs is also being conducted in the Georgian and Latvian SSR's, Kiev, Zaporozhye, Krasnoyarsk and other regions of the country.

The necessity of territorial management of scientific-technical progress is most obvious in the field of automation of territorial systems control processes. This is due not only to the comprehensive nature of territorial systems, but also to the possibilities of more economic utilization of computing technology resources. At the present time, our country has broadly expanded the development and introduction of territorial automated control systems in Moscow, Leningrad, Kiev, Yerevan, Tomsk and other places, during the formation of which it is planned not only to use computing technology in management practice, but also broad utilization of the systems approach in formation of integrated control models.

However, there are still substantial shortcomings in work. Territorial automated control systems are being developed in many cities by numerous academic institutes, sectorial scientific research institutes and VUZ's. Insufficient coordination of activities and the desire of every organization to show its own initiative and its own approach occasionally lead to the fact that expensive systems are created and projects are developed which cannot be used owing to shortage of resources and insufficient qualification of associates. Much is explained by insufficient utilization of information that is available to all collectives and of computing technology.

Improvement in management of scientific-technical progress is connected with the establishment of collective computer centers (VTsKP), which provide a broad access to information that is now stored in various departments and services. A set of standard series of problems and data banks, which could be broadly used by territorial management organs in adopting quality decisions with regard to ensuring dynamic and balanced development of territorial systems, should also be prepared.

Corresponding management organs are necessary for carrying out the aforementioned work and coordinating activities of executors. Appearing as such organs are special sections in the composition of scientific-technical progress councils of party committees and local soviets and standing deputy commissions. One of the first commissions was formed in the Kiev City Soviet of People's Deputies. Improvement in work with regard to formation by territorial systems of automated control systems requires more active participation of their users and also assistance from central organs. Much also depends on the formation of correct position of developers of these automatic control systems.

Thus, party committees and local soviets appear as higher departmental organs in territorial management of scientific-technical progress. They pursue the party's socioeconomic policy locally and implement measures with regard to general intensification of productive forces and leveling conditions in social development of regions. Realization of these tasks is possible by means of enlisting workers' creative potential on the basis of raising the level of their economic and technical knowledge, political awareness and moral training and involving them in management of enterprises, rayons, cities and oblasts.

The June (1983) plenum of the CPSU Central Committee pointed to the necessity of linking ideological work more closely with the struggle for fulfillment of key national economic and sociopolitical tasks. The formation of opinions and economic thought on the one hand are influenced by economic mechanism and on the other hand by ideological training, comprehension of phenomena of economic life in their logical interrelatioship and realization by every worker of his place in social production. Best results may be achieved on the condition that economic and organizational measures being conducted by territorial organs are combined with ideological and political ones.

Participation by workers in management is of great economic and sociopolitical significance. In the economic sense it is expressed in adopting effective measures with regard to revealing and using production reserves and achieving high final results. In the sociopolitical sense this participation consists in the development of a feeling of awareness of being a master of one's own enterprise, kolkhoz, rayon, city and so forth. Securing by the USSR Law on Labor Collectives and Raising Their Role in Management of Eneterprises, Institutions and Organizations of democratic principles in management will make it possible to realize these tasks more fully.

Marxist-Leninist studies are called upon to play a great role in introduction of scientific-technical achievements. The experience of Marxist-Leninist studies in the Siberian Department of the USSR Academy of Sciences, which are conducted in close connection with practical tasks, received high appraisal at the 26th CPSU Congress. Many current national economic problems were formulated in the course of studies, the work in solving them became more active and the methodology of developing regional scientific-technical and economic programs was formulated. The overall result was development of the large-scale "Sibir'" scientific-production program, which became the basic content of ideological and political work of party organizations of institutes and mass media. Scientific workers have manifested great interest in mastering Marxist-Leninist world outlook and methodology, which made it possible for them to actively influence development of production.

Economic education plays an important role in accelerating NTP [scientific-technical progress] in regions. It begins with revealing tasks with regard to improving production, comprehensive development of regions, measures being planned for introducing scientific and technical achievements, writing educational programs and study aids and studying and is concluded with practical realization of proposals by students on solving these tasks and training in economic work skills. In the process it is important to train people from a professional standpoint as well as theeconomic, ideological and psychological ones. If this is not done then innovations do not arouse interest in inroducing them. Scientific and practical conferences, party committee plenums and sessions of soviets of people's deputies have a great effect upon the consolidation of scientists and production specialists.

The quality of plans for ideological support of scientific-technical programs, which are drawn up in regions, are of particular significance. The formation of the so-called comprehensive plans for ideological training of collectives of rayons, cities and oblasts often occurs without the necessary combination of

ideological and scientific-technical activity. For example, a study of the activity of organizations which engage in scientific-technical information and propaganda (the USSR GKNT [State Committee for Science and Technology], the sectorial network of its scientific-technical information, the USSR Academy of Sciences, the Society of Knowledge, the NTO [Scientific-Technical Society], the VOIR [All-Union Society of Inventors and Efficiency Experts], the press, radio, television, club institutions and others) indicates that their activity is occasionally not coordinated and therefore the necessary effectiveness in dissemination of scientific, technical and production achievements is not ensured.

In our opinion, the experience of party organizations which assign to territorial scientific-technical information centers of the USSR State Committee for Science and Technology the functions of leading organizations with regard to developing and coordinating fulfillment of plans for scientific-technical propaganda and coordinate them with the work of ideological support organizations merits attention. The aforementioned centers could also cope successfully with the functions of introducing innovations on a cost accounting basis. The study and dissemination of this experience would make it possible to create a well-balanced system for the management of propaganda and utilization of scientific-technical achievements in regions.

Planning of Scientific Research and Development in the National Economy

Despite common principles and content of state and sectorial planning of scientific and technical development, the organization of sectorial plan development in every industrial ministry has its own specific nature.

The basic form of planning of science and technology in sectors of industry at the present time is a five-year plan with distribution of tasks by years. A sectorial five-year plan for the development of science and technology is developed as part of a sector-wide plan and is an important means for coordinating scientific research and development which is carried out in a sector. The indicators and tasks of this plan are used as initial ones for development of all other sections of a long-range plan for the development of a sector.

A sectorial plan for the development of science and technology usually includes:

overall indicators of the technical level of production and produced output;

tasks for solving most important sectorial scientific-technical problems;

tasks for mastering new kinds of industrial production;

tasks for introduction of advanced technology and mechanization and automation of production processes;

economic effect of scientific-technical measures;
standardization and unification of the most important types of production;
financing of scientific research and development; and

training of scientific and scientific-pedagogical personnel.

The overall indicators of a sectorial plan reflect the final economic results of scientific and technical development and include tasks for increasing labor productivity, reducing production costs, increasing volume and improving structure of production, raising production quality and level of technology and improving management of production.

The remaining sections of the plan for development of science and technology include lists of specific measures. The expediency of including every measure is substantiated by calculation of an expected economic effect. For every task that is connected with developing and mastering in production of new goods, technology or materials, technical level charts are made, which include an all-round appraisal of the quality level of new equipment compared with the best domestic and foreign models.

The development of a sectorial five-year plan for development of science and technology provides for preparation of scientific-technical forecasts for basic kinds of production being turned out, determination of long-term national economic requirements in a sector's most important kinds of production, establishment of basic scientific-technical problems in raising production efficiency and quality in a sector and establishment of mandatory subject matter of scientific research and development stemming from national economic plans and calculations of requirements in manpower, material and financial resources.

The increasing demands on acceleration of scientific-technical progress in sectors of industry and intensification of industrial production predetermine the necessity of constant improvement of sectorial systems of planning scientific research and development.

A positive experience in improving planning of scientific-technical progress has been accumulated in such sectors of industry as electrical engineering, instrument making, heavy, transport and power machine building, chemical and some other sectors. As of 1969, the USSR Ministry of the Electrical Equipment Industry introduced a new system of planning and economic stimulation of scientific research and development. The system has ensured an increase in management centralization of the sector's scientific-technical development by virtue of improving the structure of plans and raising their balanced nature as well as by introducing centralized financing of processes in the development and mastery of new equipment from a unified fund.

The sectorial plan tasks include solution of problems connected with comprehensive provision of the needs of other sectors of the national economy in electrical engineering production. Such tasks form the so-called comprehensive plans, which provide not for the development of individual but of systems of electrical engineering production for specific consumers. For example, the electrical equipment system for the ore mining industry includes comprehensive provision of a consumer with all kinds of electrical engineering production (cables, electric motors, insulators, accessories and so forth). Subsectorial plans are developed in addition to comprehensive plans, which include tasks for scientific research, experimental design and planning and technological work of individual all-union industrial associations.

Comprehensive and subsectorial plans, which are oriented toward requirements of the national economy, form the basis of subject planning in scientific research institutes and design bureaus and of planning new equipment at enterprises. The basic strategic document, which ensures comprehensive planning of processes in the development and mastery of new equipment in the electrical engineering and some other sectors of industry, in which scientific research institutes and design bureaus were switched to new management conditions, is the production order, which includes all stages of work on subjects and plays the role of an intraministerial economic agreement. Financing of the production order work is carried out in a special manner through the organization which is responsible for fulfillment of the subject.

Introduction of such planning systems for the development of science and technology in sectors of industry creates prerequisites for their broad utilization in the practice of special programmed control. In accordance with the resolution of the CPSU Central Committee and the USSR Council of Ministers on improving economic mechanism and the methodical documents, which were worked out on its basis, the cost accounting work organization system for developing, mastering and introducing new equipment on the basis of production orders is being disseminated to an overwhelming majority of scientific, design and technological organizations, enterprises and associations of industrial ministries.

Long-term planning of most important scientific research and development in the USSR Ministry of Heavy, Power and Transport Machine Building is carried out by means of drawing up subject charts for every new manufactured article, which is developed and mastered in the sector. The practice of preparing subject charts for every project of new equipment reflects the specific nature of the sector, which consists in developing, as a rule, of special purpose articles of individual and small-series production. A subject chart is prepared by a leading (according to the problem) organization and includes the entire complex of work on an article during the entire period of its development and production. Current planning and effective control over fulfillment of subject chart work is carried out on the basis of a plan-order, which is drawn up for a year.

Comprehensive planning of scientific-technical progress in the sector of tractor and agricultural machine building is carried out by means of preparing a system of sectorial plans, which are developed by leading organizations for every direction of scientific and technical development. The object of planning is an individual subject. A special order is opened for every subject. All conditions for fulfillment of an order are contained in the basic plan document --the production order.

A system was introduced in the USSR Ministry of Pulp and Paper Industry in 1977, according to which three planned accounting units are used for various plans for the development of science and technology:

for sectorial long-term plan--scientific-technical program;

for sectorial five-year plan--scientific-technical problem (subject); and

for annual scientific research work plan of scientific research institutes--scientific research work.

Separate planning on the basis of various planned accounting units makes it possible to establish a hierarchy of correlated plan documents, which strictly correspond to the scale and level of the problem being solved.

2. Special Programmed Planning Methods of Scientific-Technical Progress

Basic Principles and Content of Special Programmed Planning Method

Development and realization of comprehensive scientific-technical programs within the framework of national economic and sectorials plans of the 11th Five-Year Plan is one of the basic directions in fulfilling instructions of the 26th CPSU Congress on expanding the use of the special programmed method in management of the national economy.

Development of the special programmed method in management of scientific-technical progress is connected with some tendencies that are typical of modern science and technology, which alter substantially and extremely rapidly the requirements on planning of processes in the development and mastery of new equipment. The basic tendencies consist in the following:

first of all, the intersectorial and interdepartmental nature of the majority of scientific-technical problems being solved has sharply intensified in the past few years. For example, approximately 135 organizations-executors and 17 various ministries and departments participated in solving only individual tasks of the scientific-technical problem with regard to developing and mastering sets of machines for automated large-scale chemical production in the 10th Five-Year Plan.

second, the complexity of basic scientific-technical development problems is increasing. Plans in the field of science and technology with regard to their goals, resources and expected consequences are acquiring an increasingly more complex socioeconomic character;

third, the necessity of continuous, "integral" management of processes in the development, mastery, production and consumption of new equipment is rising every year. The length of this cycle, as a rule, exceeds the duration of plans being developed in the field of science and technology and, therefore, a need arises in developing special "integral" plans, which integrate all types of work into a unified program of activities; and

fourth, in connection with the increase in the scale of scientific-technical activity and in the cost of research and development, the necessity of strict reflection of final goals and results in planning scientific-technical progress is being intensified. A need arises in organizing such management under which the planned research and development would be oriented not toward intermediate goals but toward final national economic results.

Practical realization of a comprehensive, systems approach to solving specific scientific-technical problems requires formation of special systems of correlated and interdependent measures directed at achieving specific socioeconomic goals. Such systems of measures form special-purpose scientific-tech-

nical programs. It has become a custom to refer to the method of planning, which provides for their formation, as special programmed planning method.

The essence of the special programmed approach to management of scientific-technical progress consists in the fact that it makes it possible to realize the logic of management "from the goal," from final national economic results and ensures preparation for every scientific-technical problem a comprehensive program for its solution.

Scientific-technical programs create a particular program aspect in the planning systems of scientific-technical progress. As a plan document they are included in the plan at a corresponding level, as a rule, in form of an independent section. Scientific-technical programs cannot and should not exhaust the entire volume of scientific research and development, which is carried out at one or another level. They do not replace a plan but only strengthen its special-purpose direction by ensuring comprehensive solution of the most complex and important problems.

The special programmed approach to management of scientific research and development is also reflected in the order of development of plan documents. The process in preparing plans for the development of science and technology is split into three relatively independent stages: special-purpose, programmed and strictly planning. The task of the special-purpose stage consists of establishing and substantiating a list of special-purpose tasks, toward solution of which available resources must be directed. The content of the programmed stage is formation of correlated measures, which ensure achievement of established scientific-technical development goals. The task of this stage consists of outlining an optimum program for comprehensive solution of established problems. Coordination and regulation of the entire aggregate of scientific-technical programs within the framework of limited resources is carried out at the third stage. The goal of this stage of the management cycle consists of preparing long-term, long-range and current plans for the development of science and technology by taking outlined programs into account. On the whole the work in drawing up plans for the development of science and technology under conditions of realization of the special programmed approach is carried out by means of frequently repeated iterations in the "goals--programs--plan" cycle or in its individual parts: "goals--programs--goals" and "plan--programs--plan."

Types of Scientific-Technical Programs, Their Development and Organization of Fulfillment.

Scientific-technical programs are the most important element of special programmed control.

The accepted meaning of a scientific-technical program is a planned combination of scientific, technical, production and socioeconomic measures, which are correlated with regard to resources, periods and executors and the fulfillment of which ensures achievement of an established goal.

Formation of scientific-technical programs in planning scientific research and development ensures the following: precise quantitative definition of scien-

tific-technical development goals and determination of the most important problems in the development of science and technology for the long-term; substantiated selection of ways for most effective solution of problems; balance of resources, which are necessary for the solution of every problem and their distribution according to the entire sum total of problems by taking into account their socioeconomic significance; interdepartmental coordination and efficient management of difficult combination of work; and combination of scientific-technical tasks with socioeconomic problems in the development of individual production, sector or region.

As a planning tool the scientific-technical programs ensure singlemindedness, balanced nature and continuity and scientific substantiation in solving set tasks. In this lie the basic principles of special programmed approach to management of scientific-technical development.

The specific content of scientific-technical programs depends on their type. Thus, depending on the level of development and the scale of problems being solved, programs may be international (external), national economic (intersectorial), regional, sectorial and for the development of individual organizations, enterprises and scientific and production associations.

According to period of realization and types of plans, in which they are reflected, the programs are subdivided into long-term, medium-term and short-term.

Programs at every level are differentiated according to the nature of special-purpose direction. At the level of the national economy as a whole--in the state five-year plan for development of science and technology--there are provisions, as has already been noted, for two types of scientific-technical programs which are different in content: special-purpose comprehensive scientific-technical programs and programs for solving most important scientific-technical problems. The following types of scientific-technical programs may be developed in sectors of industry:

development of original models of manufactured articles, which are based on new physical principals;

development and mastering production of single standardized series of articles;

development and mastering production of sets of equipment for individual sectors of the national economy;

expansion and saturation of goods utilization spheres;

development and introduction in industrial operation of highly efficient technological processes;

development, extraction and utilization in production of new kinds of raw materials and supplies;

development, commissioning and mastering automated control systems;

development and introduction of environmental protection methods and means; and others.

The development of comprehensive scientific-technical programs is organized according to general stages in preparing plans for the development of science and technology.

The most important element of special programmed planning is the selection of problems, for the solution of which it is expedient to develop special comprehensive programs.

The list of scientific-technical programs, which are to be included in the state plan for development of science and technology, is determined during the stage of formation of the Basic Directions of Economic and Social Development of the USSR for a planned period by the USSR State Committee for Science and Technology together with the USSR Gosplan and the USSR Academy of Sciences and by taking into consideration the proposals by ministries and departments of the USSR and union republics.

The content of sectorial scientific-technical programs is established by a ministry on the basis of a thorough analysis of the technical and economic level of production and the goods being produced and by taking into account proposals of leading scientific organizations and sectorial scientific-technical centers.

In independent scientific research institutes, design bureaus and scientific and production associations the development of programs must be provided for during preparation of drafts of long-range five-year plans for all most important directions of articles, new materials and types of technological processes being designed. Representing a qualitatively new type of planning document, the programs require a particularly methodical approach toward their development.

The formation of scientific-technical programs is exploration work of a forecasting-analytical nature. Development of a program provides for a certain consistency of procedures, among which the following stages can be singled out: clarification of quantitative parameters, which characterize the goals of a program and tasks of its realization by individual periods; formation of the composition of tasks and a combination of program measures; calculation of basic indicators of a program and resource support of a program; and processing of program documents and confirmation of a program.

During the first stage in forming scientific-technical programs, tasks with regard to developing and mastering production of new kinds of goods, production methods, materials, energy, information, equipment and production process control methods and systems can appear as goals. These tasks are expressed in the form of indicators which characterize the degree of satisfaction of national economic requirements in a specific kind of production, the level of saving living and embodied labor, absolute and relative volumes of specific production output, the degree of replacement or exclusion of obsolete production, volumes of production due to new manufacturing methods and technical and economic parameters of new complexes or machines.

The program's general line breaks up into smaller units of its component parts, forming a well-organized hierarchy of tasks which reflect the internal structure of the problem being solved.

It is a custom to identify such hierarchy of goals and tasks as a "tree of goals."[5]

During the second stage, proceeding from the goals built by the hierarcy, the composition of the program's basic tasks is established. They are formed on the basis of thoroughly analyzing the development condition of the "tree of goals" elements, the available foreign achievements in this field and prospects for their development in the USSR. The tasks of the first level are established initially. For every task of this level, specific parameters are calculated in the form of requirements to which they must correspond in order to ensure solution of a problem as a whole. Then every task of the first level is subdivided into tasks of the second, the third levels and so forth.

For every task successive stages of its fulfillment are developed. The content of work on tasks must be established in accordance with the list of standard stages confirmed by the USSR State Committee for Science and Technology.

For the purpose of ensuring high production quality of every object of new equipment outlined in the program, technical level charts are filled out according to an established form, in which the basic technical and economic parameters of the object compared with the best domestic and foreign models, the expected effect, calculated requirement and new equipment development periods are shown.

The content of the subsequent two stages (third and fourth) in formation of scientific-technical programs consists of calculating program indicators, processing and organizing fulfillment of program measures. For this purpose final clarification of a program's output parameters and their coordination with the established products list and the values of indicators of a corresponding national or sectorial plan is carried out on the basis of established tasks and stages of their fulfillment.

One of the most complex problems connected with the development of special programmed methods consists of ensuring unity of the sectorial, territorial and program aspects in planning the development of science and technology. For this purpose coordination of planned measures and of resources required for their fulfillment is carried out at all stages in the development of comprehensive programs with interested ministries, departments and territorial management organs.

Comprehensive scientific-technical programs are realized through corresponding national economic and sectorial plans. For this purpose the tasks and measures contained in them are reflected (duplicated) in corresponding plans of ministries and departments, which are responsible for their fulfillment, and leading organizations as well as in sections of the plan for economic and social development of the USSR.

The organization of development of scientific-technical programs depends on their type, that is scale, significance for the national economy and scientific orientation. It is precisely these factors which determine the selection of a program client, its developer and formation of program management organs. A model description of management organs of scientific-technical programs is given in Table 1.

Table 1. Description of Management Organs of Scientific-Technical Programs

Management organ	Program Development Level: intersectorial (national economic)	sectorial	association, scientific research institute, design bureau
Client	USSR State Committee for Science and Technology	Industrial ministry	All-union industrial association
	USSR Gosplan	Individual department	Scientific-production and production associations
		All-union industrial association	Scientific-technical organizations
General developer	Industrial ministry USSR Academy of Sciences Provisional Working Commission of USSR State Committee for Science and Technology	All-union industrial association Technical administration Planning and economic administration Leading organization Scientific-technical center Temporary workers collective	Leading subdivisions of scientific research institutes, design bureaus
Program supervisor	Supervisor of leading organization Institute supervisor of USSR Academy of Sciences Chairman of provisional working commission	Supervisor (deputy) of leading organization Supervisor (deputy) of scientific-technical center Supervisor of temporary workers collective	Supervisor of leading subdivision Chief specialist of organization Supervisor of temporary workers collective
Developers-executors	Sectorial scientific research institutes, design bureaus, planning and design and technological organizations Scientific-production associations Industrial enterprises Special subdivisions	Scientific research institutes, design bureaus, planning and design and technological organizations Industrial enterprises Special expert commissions	Subdivisions of leading organizations Consumer engerprises Special expert commissions

Simultaneously with determining the content of scientific-technical programs, which are to be solved in the long-range period, the USSR State Committee for Science and Technology assigns the ministry which will be responsible for development and fulfillment of each program.

A leading ministry (department) prepares a draft program and submits it for confirmation to the USSR State Committee for Science and Technology, the USSR Gosplan and the USSR Gosstroy. For the purpose of supervising development and implementing scientific-technical programs, a leading ministry may organize a special provisional working commission consisting of highly skilled specialists of the leading ministry and ministries and departments--co-executors.

The national economy of the USSR as well as its individual sectors have accumulated considerable positive experience of using special programmed methods in management of scientific research and development. Since the beginning of the 10th Five-Year Plan, the development of scientific-technical programs on most important national economic problems is being carried out within the framework of the state plan for development of science and technology. Included in the state 11th Five-Year Plan are 160 scientific-technical programs, including 38 special-purpose comprehensive programs. They provide for large-scale realization of most important scientific and technical achievements.

The development of special programmed methods is of particular significance for solving problems connected with environmental protection and efficient use of natural resources. Environmental protection is among those contemporary problems which are characterized by the complexity of the tasks being solved and by the global nature of the effect upon all aspects of man's life and activity. It is most closely connected with distribution of production, development of waste-free technology and production operating according to a closed production cycle, land improvement and so forth. The content of environmental problems itself predetermines the only possible organizational way of solving them, which consists of the development and realization of comprehensive programs.

To solve these complex problems, the USSR has formed a special organ--the Interdepartmental Scientific-Technical Council for Complex Environmental Protection Problems and Efficient Use of Natural Resources.

Included in scientific-technical programs of the plan for development of science and technology in the 11th Five-Year Plan are measures aimed at reducing or discontinuing the discharge into water reservoirs and atmosphere of harmful production waste. Establishment of systems of technical means to protect the environment from pollution is provided for within the framework of comprehensive programs.

The experience in developing and implementing the Dnepr special-purpose comprehensive program can be used as an example of comprehensive solution of economic, social and ecological problems in preserving and making the environment more healthier on the basis of special programmed approach. The program provides for a combination of measures aimed at most efficient utilization of water resources of the Black Sea's main artery--the Dnepr--for the purpose of preventing and eliminating depletion of water and is being developed on the initiative

of the UkSSR Academy of Sciences and the USSR Ministry of Land Reclamation and Water Resources. The scale of this program is characterized by the following figures. Participating in the realization of the program are 45 scientific institutes and 14 planning organizations of two republic academies of sciences and 13 union and republic ministries.

The experience in developing and implementing the Latvian SSR's comprehensive regional program for the protection of nature and efficient utilization of natural resources can be regarded as a positive example of programmed approach to solving economic problems. This long-term program, which was developed in 1976 for the purpose of comprehensive assurance of favorable economic production conditions and vital activity of the republic's population, is being successfully introduced in management of economic and social development of the republic. Participating in the realization of measures of this program are 19 republic and 11 union-republic ministries and departments and 19 enterprises of union jurisdiction. The overall supervision of the program is being successfully carried out by the Commission for the Protection Nature of the Latvian SSR Council of Ministers.[6]

Much experience in utilization of programmed development has been accumulated in sectors of industry such as electrical engineering, electronics, shipbuilding, chemical and some other sectors. The Ministry of the Electrical Equipment Industry has developed and is implementing fulfillment of some scientific-technical programs which provide for joint establishment with CEMA country organizations of highly efficient electrical equipment. Forms of programmed planning such as compilation of integral production orders (order cards) are widespread in sectors of the chemical industry, heavy, power and transport machine building and tractor and agricultural machine building. Their utilization ensures comprehensive solution of problems of scientific-technical development of sectors and individual produtions.

Positive practice in utilization of programmed research and development also exists in sectorial scientific organizations and associations. Thus, special programmed methods are being successfully introduced in activity planning of scientific organizations of the electronics industry. The guidance materials developed in the sector provide for precise regulation of functions of all participants in the development and realization of a program. Formation of scientific-technical programs is provided for all directions of planned equipment.

The advantages of programmed approach are manifested particularly clearly under conditions of activity of scientific organization of the chemical-technological specialization, which carry out the entire cycle of scientific research, planning and production work with regard to organization of production of new kinds of chemical products. The effect of comprehensive solution of a scientific-technical problem is manifested here, first of all, in reduction of the work cycle duration. As an example let us examine the work experience of the Leningrad Plastpolimer Scientific and Production Association. An organization chart has been prepared here of work being conducted jointly by all subdivisions of the association: scientific, planning and production subdivisions. The chart

provides for combined accomplishment of work such as scientific research, careful laboratory study of a subject, planning of an experimental installation, development of technological regulations and technological production schemes and so forth. As a result of work organization according to a combined chart, it is possible to considerably reduce the cycle duration for individual projects. Such combined charts make it possible to develop comprehensive programs which coordinate the activity not only of internal subdivisions of the association but external organizations and related enterprises as well.

Development and inclusion of special-purpose scientific-technical programs in plans for the development of science and technology signify a qualitatively new organizational form in conducting scientific research and experimental design work. This is an important step on the way to further raising the effectiveness and quality of scientific research and development, which are provided for by national economic and sectorial plans as well as by plans of associations and independent scientific research institutes and design bureaus. Utilization of programmed developments in the activity of scientific and design organizations makes it possible to raise the special-purpose direction of their thematically classified plans, to distribute available resources more efficiently. and to concentrate them in solving fundamental problems which are of primary importance for development of a sector. Realization of comprehensive scientific-technical programs makes it possible to achieve planned results in minimal possible periods by virtue of better organization and coordination of work in the new equipment development and mastery process.

FOOTNOTES

1. "Materialy Plenuma Tsentral'nogo Komiteta KPSS [Materials of the CPSU Central Committee Plenum], 22 November 1982, p 10.

2. "Metodicheskiye ukazaniya k razrabotke gosudarstvennykh planov ekonomicheskogo i sotsial'nogo razvitiya SSSR" [Methodical Instructions on Working Out State Plans for Economic and Social Development of the USSR], Moscow, Ekonomika, 1980, pp 9-34.

3. "Problemy i osnovnyye napravleniya razvitiya Novosibirskoy oblasti" [Problems and Basic Directions of Development of Novosibirsk Oblast], Novosibirsk, Nauka, 1980.

4. "Nauka--proizvodstvo--effektivnost'" [Science--Production--Effectiveness], Novosibirsk, Nauka, 1982, pp 20-23.

5. G. S. Pospelov, V. A. Irikov. "Programmno-tselevoye planirovaniya i upravleniye (vvedeniye)" [Special Programmed Planning and Management (Introduction)]. Moscow, Sovetskoye Radio, 1976, pp 153-158.

6. "Programmno-tselevoye upravleniye sotsialisticheskim proizvodstvom. Voprosy teorii i praktiki" [Special Programmed Control of Socialist Production. Questions of Theory and Practice], Moscow, Ekonomika, 1980, p 208.

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BUDGET AND FINANCE

RESOURCE UTILIZATION AT UZBEK SCIENTIFIC INSTITUTIONS

Tashkent EKONOMIKA I ZHIZN in Russian No 4, Apr 85 pp 32-34

[Article by T. Khankhodzhayev, chief of a department of the Uzbek SSR Committee of People's Control: "Become an Immutable Law. How the Material, Technical and Financial Resources Being Allocated to Scientific Institutions Are Being Used"]

[Text] The state annually allocates to scientific institutions significant material, technical and financial resources. A larger and larger portion of them is being channeled into the supply of laboratories and chairs with equipment, apparatus and instruments--the current level of scientific research requires this.

Thus, for example, for the republic Academy of Sciences during [illegible] Year Plan the amounts allocated for these purposes have annually increased on the average by 1.2 million rubles, and in 1985 it is planned to spend nearly 5.46 million rubles. With respect to the Uzbek SSR Ministry of Higher and Secondary Specialized Education this year this amount should come to 2.6 million rubles. The supply of higher and secondary specialized educational institutions with equipment and instruments (with allowance made for all sources) in 4 years increased by nearly 3.4-fold and came in value terms to 113.4 million rubles. The institutes of the system of the Uzbek SSR Ministry of Higher and Secondary Specialized Education in the level of technical equipment now hold one of the first places in the country.

For the purpose of coordinating the work on the acquisition, distribution and improvement of the use of equipment and instruments a new structural subdivision--the Department of the Coordination of the Technical Supply of Higher Educational Institutions and Tekhnikums--has been established in the central staff of the Uzbek SSR Ministry of Higher and Secondary Specialized Education. In the past 2-3 years much has been done, in particular, for the maximum decrease at higher educational institutions and tekhnikums of the stocks of uninstalled equipment. Its balances, which at the beginning of last year came to 2.8 million rubles, were reduced by the end of the year to 1.7 million rubles.

Laboratories for the interfaculty use of expensive and single-design equipment have been set up at a number of higher educational institutions. A scientific

center for higher educational institutions, at which a significant portion of such equipment (worth nearly 5 million rubles) is concentrated, has been organized at Tashkent State University--this center fills in accordance with contracts the orders of educational institutions of both the system of the Ministry of Higher and Secondary Specialized Education and other ministries and departments on the planned themes of scientific research.

The identification and reduction of unused and uninstalled equipment are also in the sphere of constant attention of the Presidium of the Uzbek SSR Academy of Sciences and its Department of Physical Assets and Metrological Service. Last year alone the amount of uninstalled and unused equipment in the system of the Academy of Sciences was reduced by many hundreds of units, the value of which is expressed in enormous amounts. Suffice it to say that just the equipment, which is not in working order, was reduced in 6 months from 741 units (worth 1.14 million rubles) to 499 units (worth 698,000 rubles).

At the same time it is also possible to name many cases of mismanagement in the sphere which is being spoken about. At Samarkand State University, at the construction site of the main educational building, a shed for the storage of equipment which has arrived for a long time was not built. Packaged equipment, which arrived for the construction of the scientific center of higher educational institutions attached to Tashkent State University, was also outdoors. The same situation was also established by us at the construction site of the laboratory building of composite polymers of Tashkent Polytechnical Institute. And although they took steps to eliminate the shortcomings, it is impossible not to speak about these facts--this can do harm to the state.

At the beginning of this year equipment valued at 127,000 rubles was not being used at the Institute of Biochemistry. At the Institute of Geology and Geophysics 240 units of equipment and instruments worth 185,000 rubles were not in working order, at the Institute of Seismology--105 units (52,000 rubles). The same picture to one extent or another is observed at the Physical Technical Institute and the Kibernetika Scientific Production Association. All this testifies that the pace of the construction of the facilities being put into operation in the system of the Uzbek SSR Academy of Sciences should be sped up significantly and the work of the repair service, which should be manned with skilled specialists, should be improved drastically. The work of the center for the rental of equipment and instruments also needs improvement.

At scientific research institutes of the applied nature measuring instruments and equipment hold a significant place among the equipment. Their importance in the development of scientific research dictated the need for the organization of metrological services within the organs of the management of science at large scientific institutions. However, their activity today leaves much to be desired.

The survey recently conducted by the Uzbek SSR State Committee for Standards at the Institute of Power Engineering and Automation established that of the checked 165 means of measurement 68 are unsuitable for use. What is more, it turned out that all 100 percent of the instruments of radio engineering

measurements, which are used at the institute for conducting scientific research, are unsuitable for use. They are also devoting inadequate attention to metrological support at the Institute of Mechanics and Seismic Stability of the Uzbek SSR Academy of Sciences. At the Central Scientific Research Institute of the Cotton Industry of the USSR Ministry of Light Industry 30 percent of the checked instruments either were inoperative or the dates of state checking, which was established for them, had expired. All this attests that in this matter the control on the part of the organs of the republic State Committee for Standards should be more exacting and efficient.

To consume efficiently and carefully in the national economy material, technical and financial resources, to use efficiently every unit of equipment, materials and means of transportation and every ruble allocated by the state--party documents aim us at this. But, unfortunately, there are still scientific institutions, at which a barrier has not been erected against mismanagement, the wasteful consumption of material and monetary resources and, at times, their direct squandering. The checks made by People's Control organs at several scientific institutions and their pilot experimental subdivisions confirm what has been said.

In the middle of last year at the main institute of the Kibernetika Scientific Production Association, the special planning and design bureau of automated control systems and the pilot experimental plant of the Kibernetika Scientific Production Association there were above-standard physical assets worth 243,000 rubles. Moreover, illiquid stocks worth 166,000 rubles had been formed at these organizations. But the above-standard stocks of physical assets at some one institution are a version of the freezing of the equipment, implements and materials, which, perhaps, other institutions need.

But here is what was shown by the check made last year at the cost accounting base for the supply of scientific institutions, the warehouse for the making up of complete sets of the administration of capital construction and the garage of the Uzbek SSR Academy of Sciences. The preservation of physical assets is not ensured here, inventories were conducted inopportunely and with a poor quality, shortages and surpluses of physical assets worth large amounts were discovered. But what such a fact is worth. At the cost accounting base of the Uzbek SSR Academy of Sciences at each of three warehouses their chiefs were relieved two or three times each in 2 years, eight of them were dismissed when there were shortages of physical assets worth at total amount of more than 155,000 rubles. A shortage of assets--worth 46,300 rubles--was also found for the other three chiefs of the warehouses of this base, who were working at the moment of the check. At the warehouse for the making up of complete sets of the Administration of Capital Construction of the academy the value of a number of physical assets was arbitrarily overstated in the inventory records--in this way they attempted here to conceal the amount of the shortage. All this should not be surprising, if we recall that more than 30 people without any documents at all were hired at different times to work at the cost accounting base. Where was intradepartmental control looking in this case?

By the efforts of the new leadership of the Presidium of the Uzbek SSR Academy of Sciences the shortcomings, which were identified by the republic Committee

of People's Control, have now practically been eliminated: a number of officials, who are in charge of economic organizations which supply scientific institutions with equipment and materials, incurred strict punishment; the materials on individual workers were send to investigative organs.

The cases of the wasteful use of means of motor transport and strictly centrally allocated fuel and energy resources should become the topic of a special discussion. Let us cite, for example, such an eloquent example. At the Uzbek Experimental Station of Bast Fiber Crops of the Central Asian Department of the All-Union Academy of Agricultural Sciences imeni V. I. Lenin two buses for 2 years were turned over for use to one of the local trade organizations--together with drivers, fuel and lubricants. The expenses of the station on the maintenance of these buses came to more than 7,000 rubles. Over 3 years the same station sold to outside organizations 115,000 liters of strictly centrally allocated gasoline worth 58,000 rubles. Fuel and lubricants were unsatisfactorily stored and improperly released at the pilot experimental farm of the All-Union Scientific Research Institute of Cotton Selection and Seed Growing. At the central warehouse of this farm three chiefs were relieved in a year. For two of them a shortage of physical assets worth 4,500 rubles was revealed.

It is impossible also not to speak about the fact that at several scientific institutions overexpenditures of the estimated allocations and other violations of economic and financial discipline are being allowed. Thus, the check of the Uzbek Scientific Research Institute of Veterinary Science of the Central Asian Department of the All-Union Academy of Agricultural Sciences imeni V. I. Lenin showed that here too high salaries as against the manning table were groundlessly established for associates, as a result of which in 3 years and 5 months 19,800 rubles were paid illegally. At the scientific subdivisions of the institute more than 20 associates were kept in excess of the staff. At the pilot experimental farm the groundless payments just to managers of the subdivisions during the indicated period came to 14,300 rubles. The following facts were also discovered here: workers of the boiler house and the personnel division, for example, were paid the wage of scientific associates and laboratory assistants.

It should be noted that at some institutions they do not always adhere strictly to the approved estimates in case of the expenditure of assets. Thus, at the Uzbek Scientific Research Institute of Epidemiology, Microbiology and Infectious Diseases the overspending on the acquisition of equipment and implements came to 98,000 rubles. Moreover, a significant portion of this equipment and implements is not being used or is being used for the wrong purpose.

The state of affairs is also being aggravated by the fact that at several scientific institutions the expenditures, which have been made for the elaboration of individual themes, for some reasons or others prove to be unproductive. For example, at the Uzbek Scientific Research Institute of Veterinary Science for just one unfinished theme such expenditures came to 16,000 rubles, for three jobs performed by the Uzbek Experimental Station of Bast Fiber Crops they came to more than 70,000 rubles. Four laboratories of the Uzbek Institute of Epidemiology, Microbiology and Infectious Diseases, on

the maintenance of which about 200,000 rubles were spent in 3.5 years, did not turn over at all for introduction a single recommendation. At the Kibernetika Scientific Production Association with respect to a number of economic contractual themes the research and development were curtailed or terminated without an end result. The expenditures on the performed amounts of this scientific development came to more than 580,000 rubles. Is it possible to call these expenditures anything but unproductive!

One of the manifestations of the lack of organization in economic matters is wastefulness, an uneconomical attitude toward raw materials, materials, energy. Thrift should become an immutable law of all our economic life.

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FACILITIES AND MANPOWER

INSTITUTE OF NUCLEAR POWER ENGINEERING CREATED IN OBNINSK

Moscow SOVETSKAYA ROSSIYA in Russian No 200, 31 Aug 85 p 2

[Text] Obninsk--the organization of a new higher educational institution--the Institute of Nuclear Power Engineering--has been dictated by the rapid growth of Soviet nuclear power industry. This institute is being organized on the basis of the Moscow Engineering Physics Institute's Obninsk affiliate. It will train specialists in the designing, building and operation of nuclear power stations.

Under construction in a picturesque wooded area on the outskirts of Obninsk is a campus consisting of five zones: classroom, research, domitory, sports, and administrative.

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FACILITIES AND MANPOWER

NEW GENERAL-REANIMATOLOGY INSTITUTE'S R&D ROLE AND PLANS

Moscow MEDITSINSKAYA GAZETA in Russian, No 62, 2 Aug 85, p 3

ZAGAL'SKIY, L. (interviewer)

[Abstract] The article is an interview with Vladimir Aleksandrovich Negovskiy, member of the USSR Academy of Medical Sciences (AMN SSSR), director of the academy's Institute of General Reanimatology and a USSR State Prize laureate, regarding the activities and plans of the institute he heads. It was organized recenton on the basis of AMN SSR's Scientific Research Laboratory of General Reanimatology.

Tracing the institute's history, Negovskiy recalls that he was one of those who initiated the creation of a special-purpose laboratory at the Institute of Neurosurgery in 1936. This laboratory provided a nucleus for the future laboratory of general reanimatology. Personnel of the laboratory pionerred the development of new types of resuscitation equipment and new methods for post-reanimation rehabilitative therapy. The laboratory initiated the preparation of a manual, "Instructions Regarding Cerebral Death," which was recently accepted for use at a number of leading institutes. Associates of the laboratory were awarded 10 certificates of invention and two USSR State prizes for their developments.

Negovskiy reports that the institute is carrying on and expanding work begun by the laboratory on such important problems as the prevention and treatment of encephalopathies. Work is in progress on automating practically all types of functions performed by reanimation units. Comprehensive research is being done with the participation of the Scientific Research Center of Computer Technology, the All-Union Scientific Research and Testing Institute of Medical Technology, and a number of other organizations. Mention is made in this connection of a high-speed computerized system for reanimation units which has been developed at the Clinical Hospital imeni Botkin. This integrated system, one of the first of its kind in the USSR, allows several of a patient's physiological processes to be monitored simultaneously, according to Negovskiy.

The institute is said to be planning work in such directions as basic studies of terminal states; research of deep-level features and biochemical processes of the brain; and development and introduction of principles of reanimation aid at stages of medical evacuation, including principles for cases of grave multiple trauma and loss of blood.

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PROBLEMS, TRENDS IN TECHNICAL EDUCATION OF RESEARCHERS

Moscow VESTNIK VYSSHEY SHKOLY in Russian No 5, May 85 pp 25-29

[Article by Lenin Prize Winner Academician O. M. Belotserkovskiy, rector of the Moscow Physical Technical Institute: "In Combination With University Fundamentality"]

[Text] The present stage of the development of society is quite validly being called the age of the scientific and technical revolution. It is characterized by the dynamic flight of scientific thought, rapid technical progress and fundamental, qualitative changes in all spheres of the activity of man--from elementary technological operations to the control of large industrial complexes.

The scientific and technical revolution is having a profound influence on all levels and areas of general and specialized education, including the higher school. We will touch upon below only a portion of the problems and trends of the development of modern higher technical education, which seem most important to us in the sphere of the training of personnel of the research type of the physical technical direction.

The problem of the quality of the training of specialists is now proving to be basic. The increase of the demands here stems from the acceleration of social processes, the increase of the role of the subjective factor in the realization of the laws of social development, the rapid extension of the scientific principles of management to all areas of social life and the new possibilities for the improvement of the social structure of society and social relations in the direction of the achievement of full social equality and the comprehensive development of the individual in our society. These and other trends predetermine the fundamentally new directions of the improvement of higher education.

Under the conditions of the scientific and technical revolution new scientific directions are emerging and developing extremely rapidly. In this connection the need for personnel of newer and newer types is appearing, and the occupational mobility of the specialists being trained is becoming another main requirement. Generally speaking, there is a certain discrepancy between the constantly increasing demands on specialists and a certain conservatism of the system of education, which has less dynamicness as compared with science

and production. The fundamental reorientation of higher education and the changeover from the extensive informative to the intensive fundamental principle of training, in our opinion, are necessary in order to take adequately into account in training the dynamic process of the development of science, technology and production and to ensure the appropriate content of the training of specialists.

The entire system of education is called upon to ensure the fundamental and methodological training of specialists in a specific field of knowledge. And on this basis it is necessary to develop the creative abilities of undergraduates and to form in them profound philosophical principles, high standards of thinking and the ability to get their bearings independently in the voluminous information of scientific, technical and sociopolitical life. The realization of the concept of a specialist of the general type should hold a special place in the work of modern higher technical educational institutions. This is in full accord with the current rapid growth of production and its continuous retooling, when the ability of the specialist to see the prospects of the development of his sector and the economy of the country as a whole and to solve in a qualified manner the problems of the scientific organization of labor and production management is assuming a most important role.

However, not only industry, but also science require as well that the system of education be sufficiently mobile and be capable of training in a short time the necessary number of specialists of the needed type. During the postwar years precisely this circumstance led to the organization of a number of specialized faculties and higher educational institutions of a new type--kinds of technical universities, which began to carry out the training of personnel in various areas of modern physics and new technology.

Difficult, combined scientific, engineering and production problems, which prove to be closely interconnected, now face specialists of the most different directions. For example, space research posed for engineers and aerodynamics specialists an entire set of completely new problems, which are connected with the determination of the aerodynamic characteristics of rockets and descent vehicles. Here we are faced with the fundamental interweaving of purely scientific problems (which are usually connected with the statement and solution of complicated nonlinear problems of physical gas dynamics), applied problems (the development of effective methods of solution and their introduction), engineering problems (the search for the optimum solutions from the point of view of the entire system as a whole with reliance on the results of theoretical and full-scale research), as well as exclusively production problems, which are connected with the implementation of plans.

Recent years have been the stage of the most intensive development of diverse scientific and engineering methods of research, and the extensive introduction of high-speed computers in the practice of applied development was of decisive importance for this process. As a result, the need for the training of researchers and applied scientists, who combine thorough theoretical and broad engineering training and are capable of solving the complex scientific and technical problems which arise at the boundary between different fields of knowledge, increased.

Finally--and this aspect seems very important--modern practice requires more perfect forms of the alliance of the higher school with science and production. Such an alliance is becoming one of the main principles of the development of the higher school.

The constant search for new forms of higher education are necessary for the effective solution of the mentioned problems. Here it is appropriate to make a small historical digression.

Different social ages made their own demands on the forms and content of education. Our famous countryman M. V. Lomonosov more than 200 years ago, on the threshold of the rapid development of Russia, founded the first Russian university. The French bourgeois revolution contributed to the establishment of a unified state system of education and the organization of such educational institutes as the Ecole Normale and Ecole Polytechnique (both were founded in 1794). The industrial revolution in Russia in the second half of the 18th century led to the founding of the higher engineering school, of which the Mining School (now the Leningrad Mining Institute), which was founded in 1773, was the firstling.

Great October created fundamentally new prerequisites for the comprehensive and intensive development of the domestic higher school. Various fields of higher education, which trained personnel for practically all areas of the national economy and culture, were organized and quickly gained strength. University and higher technical educations became the basic directions. Universities ensure the broad general scientific training of specialists, but, as a rule, do not fully prepare graduates for work in industrial laboratories and applied institutes. The technical higher school in many cases does not give an adequate breadth of education.

Today a certain convergence of university and technical education is being observed. A number of higher educational institutions, which combine components (if you wish, the strong points) of the university and the technical school, have been founded. A larger and larger number of technical higher educational institutions are striving to incorporate in the basis of their curricula university fundamentality in combination with the considerable engineering training of students in the latest fields of technology. The central principle of the activity of such higher educational institutions is the training of specialists in cooperation with scientific research institutes, design bureaus and industry and the setting up of educational scientific production associations. Among such educational institutions it is possible to name Moscow institutes--the Physical Technical and Engineering Physics Institutes, the Institute of Radio Engineering, Electronics and Automation, the Institute of Electronic Engineering and the Institute of Electronic Machine Building, the Leningrad Technological Institute imeni Lensoveta, Novosibirsk University and others (let us note that back in the 1930's Leningrad Polytechnical Institute at one of its faculties began to train staffs of researchers in close cooperation with scientific institutions and plants).

In our opinion, educational institutions of precisely such a type, which it would be possible to call technical universities, are that form of higher education, which is capable of effectively solving the problems posed by the scientific and technical revolution. If we briefly formulate the basic principles which should be incorporated when training specialists in the system of the technical university, in our opinion, they reduce to the following: the fundamentality of education; the introduction of scientific and production activity in the training process; the purposefulness of the training of personnel and an individualized system of instruction (as applied to the requirements and tasks of the given sector); the further training of personnel.

Let us touch upon each of these principles separately.

For the achievement of the fundamentality of the education of specialists (research engineers and applied scientists) in the rapidly developing fields of science and technology it is necessary to make a thorough knowledge of fundamental subjects the basis of a general education. Mathematics, general and theoretical physics, the social sciences and a foreign language should be studied here to the extent of university courses, so that future specialists would actively command these subjects. Much attention here should be devoted to the applied, practical aspect of courses (laboratory work, independent studies, abstracts and so forth).

The main task of this general educational cycle consists in such a mastery by students of the fundamental subjects, which would develop in them active and creative thinking. Here preference should not be given to the thoroughness of the courses being taken to the detriment of the ideological and creative aspect of education (incidentally, precisely such an approach also distinguishes, in our opinion, training from education).

After the general educational cycle comes the special cycle. It begins with the taking of courses and the performance of laboratory work of the general type, but already within the chosen specialization (electronics and radio engineering, general and applied physics, control and applied mathematics and others). As a result a specific breadth of education and specialized training is achieved.

The third cycle is the research cycle. Its goal is training in a specific (narrower, but more fundamental) specialty. This cycle should be carried out in well-equipped laboratories of the institute or base enterprises. It is important that specialists, who are actively working in the given field of science and technology, would do the teaching here. The involvement of the research engineer during training in active independent scientific or production work is a necessary condition of his training.

Such a breakdown of the educational process into three independent cycles makes it possible to manage them efficiently, by ensuring mobility and purposefulness in the training of personnel, as well as creates the prerequisites for the development of an individualized system of instruction.

If we speak about the Moscow Physical Technical Institute, precisely the fundamentality of education and the existence of a large group of base institutes, into which specialized chairs have been drawn, distinguish its system of instruction. The production cycle of training is carried out, in essence, "in the provinces."

Today nearly everyone agrees with the thesis of the fundamentality of education. However, its implementation in practice entails the overcoming of a number of difficulties. First, a certain modernization of the curricula is required for this. Second, a strong staff of instructors of general technical chairs and well-trained students are necessary. Third, the programs of the subjects of the fundamental general educational cycle should be connected most closely and naturally with specialized courses.

When speaking about "purposefulness" in the training of personnel, we have in mind the following: the higher educational institution is obliged to have a clear idea of where, when and how many specialists of one type or another it should send.

And the more accurately the higher educational institution knows the answers to these questions, the more efficient and creative all its activity will be. Therefore, we are in favor of direct contacts of the higher educational institution with sectorial ministries and departments (and even better, with specific base enterprises). It seems that within the main administration, to which the higher educational institution belongs, it is always possible to divide the "spheres of influence" of higher educational institutions and to make the assignment of specialists more purposeful. Then the questions of the practical production work of students, the supervision of graduation designing and so forth will also naturally be eliminated. Here it is impossible, of course, also to disregard the psychological orientation of the student himself.

It seems to us that the system of base enterprises should be disseminated more extensively--initially they should be singled out at the stage of graduation designing, and then (with the increase of the mutual interest of the higher educational institution and the enterprise) also at the stage of the immediate process of training. Here, it is true, additional duties, for example, the study of the conditions of the needs for specialists, rest with the higher educational institution. However, large educational institutions are quite capable of this.

At the Physical Technical Institute much attention is being devote to the problems of the "demand and assignment" of graduates, we are accordingly guiding and reorienting upperclassmen. In recent years there were organized at the institute without an appreciable increase of the number of students a number of new faculties: physical and quantum electronics (1964), aeromechanics and flight engineering (1965), control and applied mathematics (1969--for the first time in the country), problems of physics and power engineering (1976); finally, the Physical Chemical Biology and Biotechnology Faculty was opened in 1981. The material base was formed, as a rule, at the expense of industrial ministries and departments; training was organized

practically immediately in all courses--and after 1.5-2 years the new specialties held the first graduation.

The Moscow Physical Technical Institute is most closely connected with the USSR Academy of Sciences in the matter of training scientists both for the academy itself and (through its institutes) for sectorial scientific research institutes and design bureaus of various ministries and departments. We believe that the system of the training of specialists "higher educational institution--Academy of Sciences--industry" will also be developed further.

Thus, the combination of the fundamentality of general technical education and purposefulness in the training of specialists seems to us to be a very urgent trend of the development of modern engineering education. Precisely such a concept also dictates the formation of the content and the forms of higher education according to the system "purposeful type--on a broad basis."

In the general system of higher education the problem, which is connected with the existing gap between "stable" programs of higher educational institutions (and accordingly the nature of the knowledge of graduates) and the level of the constant and rapid development of science and technology, is very urgent. At times the following opinion is voiced: since the change of the programs of higher educational institutions is a more or less protracted matter, under the conditions of the rapid development of scientific knowledge such a gap is practically inevitable. This seems insufficiently sound to us. The system of instruction, which combines fundamentally the educational process and the research work of those being instructed on the basis of modern laboratories and leading scientific research institutes and design bureaus, is capable of substantially reducing such a gap or even of eliminating it entirely. The experience of the work of a number of technical universities shows: when the specialized training of students is carried out in close cooperation with scientific research institutes and design bureaus, the professional reorientation of these institutions also immediately entails changes in the nature of the knowledge being acquired by the students. As a result the graduate of a higher educational institution masters the latest achievements in the given field of knowledge, which drastically shortens the time of his adaptation when entering into production activity.

Along with base institutes educational scientific production associations are recognized as an advanced form of cooperation. The experience of several educational scientific production associations attests to the great productivity of their work. Here in practice science and production are united in the process of instruction, the training of personnel approximates as much as possible to demands of practice.

The system of the technical university makes it possible to carry out the training of specialists within a higher educational institution or even a faculty in a thoroughly individualized manner--depending on the required type. By having at a higher educational institution an extensive set of specialties, it is possible to individualize significantly the training of specialists, by varying the special and research cycles of instruction (for example, in the areas of space physics, biotechnology, physical electronics and others).

In case of the training directly of research engineers it is wise to use the idea of competitive selection, which is similar to the one which is used in case of enrollment in graduate studies. Apparently, it is inadvisable to admit all students to research work at the final stage. And it is worth considering these questions precisely now, when at many scientific research institutes a certain saturation with scientists has begun.

For a portion of the graduates due to a number of circumstances (illness, natural qualities, disenchantment with the specialty and so on) prove to be insufficiently well trained. And it seems that during the entire training period it is advisable to eliminate periodically those who do not want (or are not able) to study further, while affording them the opportunity to engage directly in production work and giving them the corresponding diploma. Such a system would make it possible to attract to the final, research cycle of instruction capable people from the outlying area (as is now done in graduate studies), to develop a more creative and intensive program of the study of this cycle and so forth.

In essence the idea of competitive selection has already been incorporated in the system of the Physical Technical Institute. Thus, in the third year our students take a final examination in general physics, in the second and fifth years they undergo certification. It should be noted that at a number of the best educational institutions of Western Europe (the Ecole Normale, France) and the United States (the Massachusetts Institute of Technology, the California Institute of Technology) such a stage-by-stage competitive selection of students for in-depth specialization justifies itself.

Apparently, only the individualized system of education will make it possible to increase gradually the quality of the training of specialists in case of the natural development and expansion of the entire system of education. And it is again easier to introduce such a system within the technical university.

The many years of the intensive training of young specialists made it possible to provide scientific institutions and new sectors of industry with highly skilled personnel. However, the development of applied research lags, as is known, behind the development of science, and many scientific achievements for many years remain accessible only to scientific research institutes. Applied specialists and production workers are not keeping pace with the rapid change of the basic directions in fundamental areas. The knowledge obtained by them at the higher educational institution becomes obsolete rather quickly. This seems natural to the workers of industry and applied scientific research institutes. Meanwhile this is quite alarming.

It seems to us that along with the training of specialists in the latest fields of science and technology the further training and on-the-job training of scientific and technical personnel should be conducted more extensively and more actively, and first of all for the basic industrial sectors and applied institutes. In this sense it is important to organize on an even larger scale at higher educational institutions the systematic further training of specialists with a higher education in the urgent problems of science and technology.

Short-term (2- to 3-week) courses for managers of enterprises, as well as month-long special-purpose scientific schools in specializations can also serve the improvement of skills. It is also advisable to retain the 1-year (or 2-year) courses of the further training of specialists with a higher education, who in the process of training also engage in independent research or production work. Such training usually concludes with the defense of a graduation project. It is possible, apparently, to grant those who completed the courses with distinction to "register" the minimum candidate degree requirements (the demands reflected in the programs of such courses, as a rule, are greater than those made in the candidate degree examinations).

Such a system of the further training of personnel has been operating, particularly at the Moscow Physical Technical Institute, for more than 10 years, moreover, organizationally it has been designed as a specialized faculty. Such subdivisions also exist at a number of other higher educational institutions. We, however, consider it advisable to organize at our institute a center of the further training of personnel in a wide range of specializations.

Local television should also be used more actively for the further training of personnel: it is possible by means of it in three or four semesters to give and relay lectures from the centers of higher educational institutions for a significant audience.

The most important component of the basic education and communist training of students is their philosophical training. The world outlook of students is formed under the influence of many factors. In this case we would like to dwell only on individual features of this complex process, particularly the role of the educational process in the formation of a scientific world outlook of those being trained.

Here the study of the social sciences is of prime importance, and the chairs are actively seeking ways of improving their work. In our opinion, the assurance of the connection of the lecture courses being given with the specialization of the higher educational institution and the specific international situation serves as one of the effective means. This is important for all social disciplines, but especially for philosophy and scientific communism. Marxist-Leninist philosophy is not only a science which has its own subject of research, but also the methodological base of all other sciences. It is clear that the methodological function of philosophy should be examined with allowance made for the specific nature of the higher educational institution. Therefore it is desirable, for example, for a lecturer in dialectical materialism to have not only a basic, but also a specialized physical mathematical education.

Another aspect of the process of improving the philosophical training of students is the orientation toward the humanities of the teaching of natural science and technical subjects. Without aspiring to the thoroughness of the coverage of this question, we would like to direct attention to three things.

First, the aspects connected with the formulation of scientific theories should find reflection in the series of lectures on natural and technical

subjects. At times people object to this, declaring that students need knowledge in its modern form and skills of its use for the solution of problems in the given field of science. However, such an opposition of the historical and the theoretical and applied aspects is hardly justified. The history of the development of scientific theories makes it possible to "drop in" on the creative laboratory of scientists and to understand more thoroughly the essence of scientific achievements. Such an approach increases the possibilities of strengthening the educational element of lectures, since students get to know the priority of outstanding Soviet scientists and their contribution to science.

Second, in lectures on general technical and applied subjects it is advisable along with special problems to touch upon the social aspects of technical progress. Such issues as man and technology, society and nature, cybernetics and production should find reflection in the courses of not only social, but also specialized subjects.

Third, the basic sciences in their development and formation are faced with both special and methodological problems. This is especially characteristic of the periods of scientific revolutions, when the conceptual reform of science and the revision of a number of its laws and principles occur, which prompts scientists to discuss the most basic, including historical and philosophical, problems of science. Such is the situation in science itself, and this cannot but find reflection in the process of teaching social and specialized subjects.

In short, in our opinion, the orientation of teaching toward the humanities is one of the means of extending the philosophical training of students. Without belittling the importance of various methods of educational work, it is possible to assume that the educational process is the main link in the way of the solution of this problem. Therefore, it is necessary to see to it that the instructors of all chairs would acquire a taste for and an interest in social and methodological problems. It is possible to achieve this, in particular, by means of methodological seminars, at which the instructors actively participate in the discussion of the named problems. Moreover, it is extremely important that not secondary, but urgent methodological problems would be discussed at these seminars.

One of the most important aspects in the life of the modern higher educational institution is the question of the efficient organization of scientific research. The changeover from extensive to intensive forms of research activity is now under way in the development of science of higher educational institutions, that is, its further growth is being ensured by the increase of its efficiency, the rapid introduction of the results of basic research in production, the active use of computer technology, the improvement of the system of management and so on. The great professional mobility of scientists, that is, their ability to master quickly new directions of research, is very important precisely now.

The higher school also has to ensure the priority growth of basic development. Here, in particular, it is important to find more efficient organizational forms, which would make the scientific research institutes and laboratories of

higher educational institutions wherever possible more equal both in their contribution and in their status with similar academic and departmental institutions.
As is known, the effectiveness of research in many respects depends on the chosen themes and their urgency. In this connection the planning of scientific work at higher educational institutions has to be improved, by using more extensively the goal program methods of planning and aiming higher educational institutions at the solution of major complex problems.

The question of the more compact territorial grouping of higher educational institutions which are close in specialization, which will facilitate the establishment of joint scientific centers of higher educational institutions, also merits attention. There should be envisaged at such a center the construction of laboratory buildings and dormitories of the faculties or affiliates of the higher educational institutions, which are working in accordance with the system of the Physical Technical Institute and correspond to the specialization of the center. Such faculties (experience of their organization exists) will make it possible to use the scientific and engineering potential more efficiently for the training and education of young specialists and, on the other hand, to meet more completely the needs of scientific centers and the sectors of industry for personnel.

Another way of expanding the production base of higher educational institutions is the organization at the scientific centers of the USSR Academy of Sciences and sectorial departments of combined laboratories of higher educational institutions for the most important scientific and technical problems, at which young specialists and scientists of higher educational institutions could constantly do special course work.

The training of graduate students both at academic institutes and at higher educational institutions should be, in our opinion, of a more directed and special-purpose nature, in order to avoid the disproportion, in case of which a number of central institutes are supersaturated with scientists, while outlying higher educational institutions and scientific research institutes are experiencing an acute shortage of them. Therefore, already when enrolling in graduate studies it is desirable to stipulate the approximate place of the future job of graduates (that is, to declare vacancies not only with respect to the specialty, but also with respect to the place of assignment).

For the more complete meeting of the needs of higher educational institutions, scientific research institutes and design bureaus for personnel in the union republics it makes sense to hold locally the special-purpose recruitment of talented young people for enrollment in the leading higher educational institutions and in graduate studies for specialties which have been strictly coordinated with the republic academies of sciences. As an experiment our institute is training specialists for the Ukraine, the Urals, Siberia and the Far East. And this experience is completely justifying itself.

The discussion and solution of the problems touched upon above will make it possible, in our opinion, to use better the large scientific and technical potential of the higher school and to increase the quality of the training of specialists, which, in turn, will contribute to the more complete

accomplishment of the tasks posed by the party and government in the area of the training of highly skilled young specialists--the builders of communist society.

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TRAINING AND EDUCATION

IMPROVEMENT OF SKILLS OF SPECIALISTS IN NEW FIELDS

Moscow VESTNIK VYSSHEY SHKOLY in Russian No 5, May 85 pp 60-63

[Article by Professor M. K. Poltev and Candidate of Technical Sciences Ye. A. Kuzovchikova, the USSR Ministry of Higher and Secondary Specialized Education: "The Improvement of the Skills of Specialists in New Directions of Science and Technology"]

[Text] In conformity with the decisions of the Communist Party and the Soviet Government the policy of stepping up the work on the automation of production on the basis of advanced technological processes and versatile adjustable complexes has been adopted in the national economy of our country.

The successful accomplishment of the posed tasks depends on many factors, but one of the main ones among them is the training and the improvement of the skills of personnel, since precisely they accomplish the transition of production to a higher level. It is necessary to train management personnel and specialists for work under the new conditions by instruction in the system of skills improvement, to continuously update and extend their political and professional knowledge and to improve their professional qualities.

Being an integral part of public education, the system of skills improvement has enormous possibilities for the fulfillment of the responsible role assigned to it. Suffice it to note that at present more than 1,500 different educational institutions of the system of skills improvement, among which there are 80 sectorial, intersectorial and specialized institutes of skills improvement, 134 affiliates of them, 564 faculties of skills improvement attached to higher educational institutions and more than 600 courses, are operating in the country. Over 2.8 million people annually study here.

Having a most direct bearing on the tasks facing the sectors in the area of the acceleration of scientific and technical progress, the system of skills improvement has undergone substantial changes in recent years. As a result not only did the network of educational institutions and their capacity increase, did the content and quality of instruction and the supply of the institutes of skills improvement and the faculties of skills improvement with modern computer technology improve, was their material base strengthened and did the level of skills of professors and instructors increase, but new directions of instruction also appeared. These are microprocessor equipment,

computer-aided design systems, robotic complexes, flexible manufacturing systems, automated systems for the control of technological processes, equipment of light-guide communications systems, digital signal transduction, the standardization and information supply of automated control systems, the technical diagnosis of complex electronic systems and digital devices and so on.

During the 1983/84 school year at the institutes and faculties of skills improvement more than 37,000 management personnel and specialists of the national economy were trained in specializations which are connected with the new directions of the development of science and technology. The further increase of the student body and the broadening at educational institutions of the specializations connected with the automation of industrial production are envisaged by the plans of skills improvement for the current year. It is obvious that the education of personnel in the area of the new directions of science and technology is now almost the main aspect of the activity of the institutes and faculties of skills improvement, which are becoming genuine educational methods centers for the promotion of the achievements of science and technology and the advanced know-how of the organization of socialist production. Many educational institutions (such as the institutes of skills improvement of the Ministry of the Automotive Industry, the Ministry of the Machine Tool and Tool Building Industry and the Latvian SSR Ministry of Higher and Secondary Specialized Education and others) are taking a most direct part in the training of personnel for the fulfillment of national, republic and sectorial programs. The contacts of the institutes and faculties of skills improvement with scientific research institutes, information centers and leading production enterprises and organizations, which are used for the training of students, have been strengthened. Thus, the Moscow Institute of Skills Improvement of the Ministry of Instrument Making, Automation Equipment and Control Systems is organizing the improvement of the skills of engineering and technical personnel in the area of microprocessor equipment and computer-aided design systems directly at the base of the Institute of Control Problems of the USSR Academy of Sciences with the enlistment of its leading scientists in the conducting of the educational process; in the area of robotics--at the base of the Moscow and Kiev territorial centers of the robotization of the sector.

The specific nature of the system of skills improvement is such that management personnel and specialists in a very short time (as a rule, in 1-2 months with leave from work and up to 6 months without leave from work) should expand their knowledge with allowance made for the prospects of the development of the sector and in conformity with the held position. Here it is necessary to consider that the students of the institutes and faculties of skills improvement are certified specialists who have work experience; first of all the problems, the solution of which will help them in labor activity, interest them. In this connection the questions of the content of instruction and the competence of the professors and instructors are of exceptional importance. Owing to the specific nature of training at the institutes and faculties of skills improvement a large number of staff members of sectorial ministries and departments, party and soviet workers, scientists, managers and specialists of leading enterprises and organizations are being enlisted in the

conducting of classes here on the conditions of the combination of staff positions and the hourly remuneration of labor.

There are examples of when the management of ministries annually specifies the group of specialists who will take part in the educational process of the sectorial system of skills improvement.

Much work, which is aimed at the study and generalization of the achievements of science and technology and the advanced work experience of enterprises, is being performed by staff instructors. The fact that various sections (for example, "Machine Building," "Automated Control Systems," "Microprocessor Systems and Computer-Aided Design Systems" and others) work under the Scientific Methods Council for Problems of the Improvement of the Skills of Management Personnel and Specialists of the National Economy of the USSR Ministry of Higher and Secondary Specialized Education, to a certain extent is contributing to this.

Starting in 1980 the members of the section "Machine Building" studied at the site the work experience of the Kama Motor Vehicle Works, the Volga Motor Vehicle Works, the Rostselmash, Aksaykardandetal and Bolshevik plants, the Kiev Plant of Automatic Lathes imeni A. M. Gorkiy, the Leningradskiy metallicheskiy zavod and Izhorskiy zavod production associations and others. The obtained materials were presented at meetings of the chairs of the corresponding institutes and found reflection in the educational process with students and in methods materials.

The contact of educational institutions with production is also being accomplished by the conducting of field classes and the probationary work of students, the fulfillment by them of graduation projects in accordance with the assignments of enterprises, the conclusion of contracts on creative cooperations and the performance by several institutes of skills improvement of economic contractual operations on the most urgent directions of the development of scientific and technical progress.

At the same time is it possible to assume that the system of the improvement of the skills of personnel in its present state completely satisfies the requirements of scientific and technical progress? Of course not.

As is known, in the national economy there are a large number of specialists, who graduated long ago from educational institutions and by virtue of this do not have the necessary amount of knowledge in the area of computer technology, flexible manufacturing systems, computer-aided design systems and in other new directions. The procedure, which was established starting in 1977 and obliges all management personnel and specialists of the national economy to improve their skills no less frequently than once every 6 years, unfortunately, is being complied with by far from all ministries. The existing network of educational institutions and their capacity are obviously inadequate. Obviously, the sectorial principle of the organization of the system of skills improvement is not always an effective mechanism of its development, since many union ministries and ministries of republic subordination have not yet established their own network of educational institutions. Even such leading sectors of industry as the gas and petroleum sectors, power machine building,

machine building for light and food industry and household appliances and transport construction do not have their own institutes of skills improvement. In the regions of Siberia, the Far East and Central Asia there are few institutes and faculties of skills improvement, which are carrying out the training of management personnel and specialists of the national economy in the area of computer technology, robotic complexes, computer-aided design systems and flexible manufacturing systems.

For the elimination of such a situation it seems advisable to establish during the 12th Five-Year Plan specialized intersectorial institutes of the improvement of the skills of management personnel and specialists in the new directions of science and technology in the most important regions of the country. The need for the establishment of these educational institutions is also dictated by the fact that in conformity with the directives of the party and government the system of skills improvement is commissioned to organize starting in 1986 the mass instruction of specialists of the sectors of the national economy in work with computer technology.

In our opinion, the establishment of specialized intersectorial institutes not only will increase the capacity of the system of skills improvement, but will also make it possible to organize training more efficiently. It would be possible to concentrate the improvement of the skills of management personnel at sectorial institutes and to send specialists of mass categories to specialized intersectorial institutes or faculties of skills improvement. Experience of such training exists at the Leningrad Institute of the Improvement of Skills in the Methods and Technique of Management of the Ministry of Instrument Making, Automation Equipment and Control Systems and the Institute of Skills Improvement of the Ministry of the Machine Tool and Tool Building Industry.

For the purpose of the further perfection of the improvement of the skills of personnel in the area of the automation of production it seems advisable to distinguish the main institutes of skills improvement in each of the new directions. It seems to us that the institutes of skills improvement of the union ministries--the Ministry of the Machine Tool and Tool Building Industry, the Ministry of Instrument Making, Automation Equipment and Control Systems, the Ministry of the Electrical Equipment Industry, the Ministry of Heavy and Transport Machine Building, the Ministry of the Automotive Industry and others--should be the main institutes with respect to the various aspects of the automation of production. In our opinion, at the base of the main institutes it would be possible to organize permanent seminars for instructors of the system of skills improvement, as is now being used in practice, for example, with respect to the course of value engineering. Although such measures are very valuable for the increase of the professional level of instructors, all the same these measures alone cannot solve the problem of increasing their competence. Instructors should work on probation not less than 2-3 weeks a year at the main scientific research institutes and enterprises, which are responsible for the development, production and introduction of robotic complexes, microprocessor equipment, computer-aided design systems and so on.

The mastering by the professors and instructors of the institutes and faculties of skills improvement of the skills of work with computer technology, which should find its use in the process of studying not only the section "Equipment and Technology" of the curricula, but also the sections on economics, management and others, is no less important. Much has to be done to increase the computer competence of science teachers. In conformity with the decree of the Interdepartmental Council for the Improvement of the Skills of Management Personnel and Specialists of the National Economy this year all the instructors of the institutes and faculties of skills improvement will be instructed in work with computer technology. The mass familiarization of students with computer technology will be the next stage. For this purpose it is planned to introduce in the standard structure of the curricula of skills improvement a special section on computer technology.

Other problems, which concern the content of training, should also be solved. Unfortunately, one has occasion to be confronted at times with such a fact when, instead of acquainting the students with the latest achievements of science and technology, some instructors attempt to repeat to students the fundamentals of a course of a higher educational institution at the level of an undergraduate audience. Of course, engineering and technical personnel with different resources of knowledge, even if they work in the same sector and hold identical positions, come for training to the institutes and faculties of skills improvement. It is possible that someone of them should also repeat the course of a higher educational institution, but this must be done during the independent work of the student, which it is possible to organize very efficiently with the use of a computer.

In speaking about the extensive use of computer technology in the process of training students in new directions of science and technical, it should not be forgotten that it is possible to successfully solve this problem only when the necessary types of machines and equipment are available at educational institutions. In spite of the fact that many sectors are showing concern for their institutes and faculties of skills improvement, there are obviously not enough modern types of computers at them. The deliveries of units like the YeS-7906 and YeS-7920 are still limited, which does not make it possible to set up collective-use halls. The plans of the improvement of the skills of personnel and the plans of the supply of sectors with computer technology are not always coordinate.

As before, the question of providing educational institutions with the necessary educational material base and dormitories of the hotel type remains a sore one. This also hinders the acquaintance of students with work with computer technology, since some institutes and faculties of skills improvement have the opportunity to acquire the necessary machines, but do not have areas for their installation.

At present our country is preparing for the worthy greeting of the 27th CPSU Congress. On the threshold of the congress all the units of the system of the improvement of the skills of management personnel and specialists of the national economy are summarizing the results of their activity during the 11th Five-Year Plan. It is important that during the 12th Five-Year Plan

particular attention would be devoted to the questions of teaching all students how to use computers and perfecting the improvement of the skills of personnel in the area of thc automation of production.

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TRAINING AND EDUCATION

ON-THE-JOB VOCATIONAL TRAINING

Moscow SOTSIALISTICHESKIY TRUD in Russian No 4, Apr 85 pp 84-87

[Article by Yu. Bogdanov and V. Ryabukha, the Center of the Scientific Organization of Labor of the Ministry of Heavy and Transport Machine Building, and Candidate of Economic Sciences Ye. Skoblikov, the Penzavodprom Production Association: "Vocational Training as a Stage of the Preparation of Production"[1]]

[Text] At the present stage of the development of the socialist economy the retooling of sectors and the introduction of the latest achievements of science and advanced know-how are assuming great importance, while this in turn is increasing the demands on personnel. As is known, in recent times appreciable changes have occurred in their training, the broadening of the occupational profile and the mastering by workers of second occupations. However, the need exists for the development of specific forms of the further improvement of vocational education in conformity with the development of scientific and technical progress and for the introduction in practice of a more efficient system of the evaluation of labor results, which would envisage the consideration of all the expenditures connected with personnel training.

In order to ascertain properly, on a scientific basis the content and nature of the increase of the educational potential of workers, the place of vocational training under production conditions should be determined. Here it is necessary to proceed from the fact that any process of production regardless of its type (system) consists of two stages: its preparation and immediate production. The first stage includes three phases: the performance of scientific research and experimental design work, technical and economic (design, technological and organizational economic) preparation and, finally, the bringing of the means of production and manpower to a state of readiness. Production efficiency directly depends on the degree of completeness and perfection of each preparatory phase, on the bringing of manpower to a state of readiness for the production of a new product and on the mastering by workers of the occupational knowledge, abilities and skills, which are necessary for the output of the corresponding product.

The level of readiness of manpower for participation in immediate production depends to a decisive extent, first, on the individual educational potential of the workers, which is determined by the time of successful training at the

general educational and vocational school. Here the base educational potential, which includes the time of training until the start of direct participation in production, and the potential of the vocational and other forms of education of workers directly on the job should be distinguished. These two components directly influence the evaluation of the level of readiness of manpower for production on the condition that it can be carried out both with respect to the base educational potential and in generalized form. Second, on the quantitative and qualitative conformity of the vocational training of workers to the requirements of the technological design and organizational economic documents, which are drawn up at the stage of the preparation of production.

The transition from the industrial to the scientific and technical type of production, which, it seems, constitutes the basic content of the scientific and technical revolution, for the present is still not being carried out rapidly enough. Among the moderating factors is the lag for a number of reasons of the on-the-job vocational education of workers behind the development of production systems.

The on-the-job vocational training of workers has now become one of the necessary forms of the maintenance and development of occupational readiness for the fulfillment of specific production processes. With the adoption in 1979 of the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Further Improvement of the Training and Increase of the Skills of Workers on the Job" changes, which concern first of all the increase of the procedural support of the on-the-job vocational training of workers and the development of new programs and general demands on the educational methods and material and technical base, were made in this subsystem of education. However, its theoretical basis remained practically unchanged, since vocational education, as before, is regarded as an autonomous sphere of activity, without connection with the specific needs of enterprises which introduce the achievements of scientific and technical progress (the placement of new items into production, the assimilation of advanced technology and the transition to the more perfect organization of production management and so on).

The direct connection of the increase of skills, which is expressed in categories, and the wage does not stimulate workers to increase their occupational readiness and to use technical, technological, economic, organizational and other innovations. A situation formed, in case of which the real increase of skills in the categories in production engineering courses was not connected with the introduction of technological innovations, while the increase of the skills of workers in special-purpose courses and at schools for the study of advanced techniques and methods of labor has not yet received adequate development due to the economic uncertainty of these forms of the increase of skills and difficulties in the development of syllabuses and the organization of the training process.

In our opinion, this is a consequence of the fact that in practice the preparation of production and, along with it, the vocational training of personnel directly in it are still not included in the production process, consequently, the capital investments in this sphere of activity are

considered unproductive. However, life urgent requires that the attitude toward on-the-job vocational training be changed. In particular, a definite tendency for the level and amounts of capital investments in base education and on-the-job education to be limited is emerging.

In examining the differences and common attributes of the two types of educational potential, a number of researchers emphasize that the capital investments in education can be productive only when the social, occupational and other knowledge, abilities and skills, which are obtained in the training process, conform to specific requirements of production. The differentiation of the special-purpose functions of base general and vocational education, in our opinion, will create potential conditions for the assurance of the readiness of workers to participate in production over a long period. The specialization of on-the-job vocational education will make it possible to meet better the objective needs of the worker for the periodic updating of the natural science, social and technical knowledge which is necessary for production.

Under the conditions of the developing scientific and technical revolution on-the-job vocational education should undergo even more profound changes. It seems to us that scientific educational centers, which in addition to schools and courses of the general technical education and improvement of the skills of workers would organize courses on the further training of engineering and technical personnel, and first of all management personnel, in connection with the introduction of new equipment, advanced technology and means of control, as well as modern methods of information processing, and schools for the study of advanced techniques and methods of labor, the basic task of which is to teach workers to use the innovations which have been developed in the process of preparing production; educational production shops (sections), which are furnished with modern equipment and in which the conditions of future production should be modeled or actually created, should be set up at least at large production associations.

Attempts to oppose base general and vocational education to on-the-job education are still frequently encountered. Meanwhile a dialectical interconnection exists between these two types of education: the potentials of base general and vocational education can appear only in specific forms of production which is constantly being updated. The degree of the updating of production and, hence, of the aggregate educational potential of workers under the conditions of socialism is governed by the achievements of science and technology and by the experience of the building of socialism and the formation of the new man, consequently, this process should be carried out continuously and systematically within the preparation of production. In order to have a clear idea of what the possibilities of base education in the assurance of the socially necessary preparation of man for entering the world of production are, it should be determined what educational potential is sufficient for these purposes.

At present, when the basic directions of the reform of the general educational and vocational school are being realized, the conditions for the primary vocational adaptation and production work of adolescents 14-15 years old in combination with general education are being created everywhere. Productive

work in this case acts as a means of knowledge of real production processes and the occupational and social formation of the individual. There are at least three mandatory and interconnected conditions of a person's entry into production: the necessary social and vocational educational potential, the organization of productive labor in permissible norms and the sociologization of the individual.

Base education formed traditionally as the progressive transition from an elementary to a complete general education and further from an elementary vocational to a higher education. The build-up of the base educational potential without adequate consideration of the specific nature of the intermediate stages, at which its realization in labor occurs and in so doing the possibility of continuing one's education is preserved, led to disproportions between it and the potential of the vocational education of workers directly on the job. These disproportions increased even more due to the organizational separation of scientific research institutes and design bureaus from immediate production, which complicated the introduction of scientific achievements, while this in turn led to a decrease of the occupational activeness of engineering and technical personnel and workers. The decrease of the number of inventions and efficiency proposals, as well as prototypes of new machines per thousand scientists and engineering and technical personnel, for example, attests to this.[2] In other words, the connections between the development of new equipment, the placement of a new product into production and the formation of workers, who have been trained vocationally for its production, were broken.

In our opinion, the training of workers for the production of a new product is the joint function of the client, developer and producer of this product (unfortunately, this function and its content are not reflected in the standards which specify the procedure of the development and placement into production of a product). Therefore, the development of program and educational methods materials, which will be used for the training of workers in the process of placing the product into production, is mandatory and should be a component of the documents which are drawn up in the process of preparing production.

The educational methods materials should be turned over to production first of all, before the other documents--design, technological and economic organizational. In the process of preparing production it is necessary to include without fail the anticipatory and operational theoretical and on-the-job training of workers, engineering and technical personnel and employees in accordance with the programs of the developer.

The presently existing division of the functions of the developers of technical specifications and the developers of educational methods materials is inefficient and, in our opinion, significantly postpones the time of the placement of a product into production and decreases the efficiency of the occurrence of production processes. It often turns out that specialists, who poorly get their bearings in the peculiarities of new equipment and technology and the economic organizational support of production processes, prepare the programs, teaching aids and methods materials. The reason here is that the educational methods subdivisions of many sectors are isolated from the

developers of new equipment and technology. In order to avoid this, in our opinion, skilled engineering teachers should be included among the developers of new equipment and technology or special subdivisions for the preparation of educational methods materials for those workers, who will assimilate developments in production, as well as will use the given type of new equipment, should be organized in the scientific and technical centers of production associations. This will make it possible to facilitate the assimilation of new equipment and the introduction of the achievements of scientific and technical progress.

Thus, the working educational methods documents should be complete textual and graphic material, which is based on the results of all the stages of the designing of new equipment and is intended for use in the educational process for the purpose of preparing workers, engineering and technical personnel and employees for participation in immediate production. In final form these documents should be revised and submitted as didactic materials, which ensure the efficient organization of the training process. This will make it possible not only to improve the quality of the future program and educational methods documents for the base general educational and vocational school, but also to coordinate them with the long-range tasks of the introduction of scientific and technical achievements.

The content of the scientific and technical innovations, which have been accepted for placement into production, thus, has a direct influence on the increase of the level of the vocational preparedness of the workers, who are participants in the production process, and an indirect influence on the workers who are employed in associated production processes. In on-the-job vocational education the planning principles should be drastically strengthened.

The proposed approach will also make it possible to eliminate the expenditures on the study, generalization and dissemination of the advanced know-how of the use of technical, technological, economic, organizational and other decisions, which are usually made in the absence of associated working educational methods documents. It is obvious that the interpretation of advanced production know-how should be made more precise and be confirmed by state standards.

The question of the importance of efficient techniques and methods of occupational activity in the formation of the individual style of work should be examined separately. Here, in our opinion, the approach of V. D. Shadrikov[3] to the substantiation of the laws of the systems formation of the occupationally important qualities of workers, including on the basis of the psychological theory of activity, is fruitful for vocational education. The standard programs of the teaching of efficient methods of work and the programs, which change subject to the appearance of qualitatively new achievements in a specific area of occupational activity, at the present stage of the development of scientific and technical progress are being mediated to a greater and greater extent by the objective requirements of production.

Efficient methods of occupational activity and an individual style of work can be formed only at technically equipped scientific educational centers, the

syllabuses for which are drawn up on the basis of complete sets of documents for technological systems. This affords the opportunity for the more complete assimilation of the methods of work on a scale, which is specified by the plans of the introduction of the achievements of scientific and technical progress. The quality of the educational process in this case will depend on the reflection in it of the aims, the development of training methods, the supply with equipment and the skills of teachers and instructors. The latter should use for the achievement of the desired occupational readiness educational methods materials which have been prepared in precise conformity with the content and goals of production processes.

The use of machines and, in particular, simulators is of particular importance for the high quality training of personnel. In this connection the experience of the training of cosmonauts is rather interesting. G. T. Beregovoy and V. A. Ponomarenko, for example, believe that simulators should ensure "the development of the necessary qualities of perception and thinking, programs of sensory-motor actions, decision strategies and so on," "make it possible to form and control the cognitive activity of man," to develop the communicative qualities and the emotional-volitional aspects of the individual, to imitate the goals and motives of activity, the peculiarities of work in collectives which are united by the community of occupational and social tasks. They attach particular importance to the new concept of training with the use of specially developed educational machines: "Thus, simulators ensure not only training and the checking of knowledge, but also the formation of the physical, psychic and social qualities of the individual, which ensure a high reliability of actions in case of the fulfillment of an assignment."[4]

The development of educational machines depends on the scale of the introduction of innovations, the number of people who should assimilate efficient techniques and methods of labor, the complexity of new equipment and other parameters, which are determined by the initial demands of the client on products. Here we must speak directly about the development of a separate subsector of machine building, which is closely connected with the production of new equipment--educational machine building. Unfortunately, at present the departments, which are concerned with the education and training of personnel, are not coordinating their activity in the production of so-called training equipment, while the unsuccessful experiments in programmed instruction have put off to the future the development of the didactic principles of the use of educational machines and equipment at the general educational and vocational school. The isolation of the developers and producers of educational machines and the inadequate attention to this question have been repeatedly spoken about at all-union and republic meetings and conferences, which were devoted to the use of this equipment for personnel training.

It is already obvious that with the development of the latest technologies the training of workers on simulators will become an immediate part of the training process. Therefore, the possibility of producing such educational machines for the vocational school, especially for the vocational and other forms of the education of workers on the job, should be considered. The educational machines, which are used for the purpose of developing the cognitive potentials of workers, should be universal and suitable for both the general educational and the vocational school. Moreover, the possibility now

already exists to select from the diversity of types of machines for the development of occupational capabilities the most promising models and to set up their centralized production.

Thus, the products list of educational machine building should include at least three types of machines: for the presentation in the educational process of various types of information; for the development of the cognitive abilities of students; for the development of the occupationally important qualities of workers, engineering and technical personnel and employees. The educational machines of the first two types are universal and can be used at the general educational and vocational school, as well as in case of the on-the-job training of personnel.

In the decree of the June (1983) CPSU Central Committee Plenum "Urgent Problems of the Ideological and Mass Political Work of the Party" the need "to expedite the elaboration of measures on the strengthening of the material and technical base of the mass media... with allowance made for their increasing importance" is indicated. The fulfillment of this requirement will make it possible to carry out at a high level the preparation of workers for participation in production, to purposefully perform ideological, educational and propaganda work and to systematically forecast the increase of the political consciousness and occupational activeness of the working people.

The improvement of on-the-job vocational education from the point of view of its influence on the effectiveness of the "science--production" link is, in our opinion, an urgent and pressing task and requires decisive steps in the organization of research and the arrangement of experiments in this area. The means of forming the educational potential of workers, as was point out above, depend not only on the elaboration of the general questions of the improvement of the general educational and vocational school, but also on the improvement of all the forms of the on-the-job education of workers in conformity with the requirements of the rapidly developing scientific and technical type of production.

It is possible to accomplish these tasks only if the forms of on-the-job education take a proper place in the system of the preparation of production.

FOOTNOTES

1. For the purpose of raising the question.

2. EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA, No 8, 1980, p 197.

3. V. D. Shadrikov, "Problemy sistemogeneza professionalnoy deyatelnosti" [The Problems of the Systems Genesis of Occupational Activity], Moscow, Nauka, 1982.

4. G. T. Beregovoy, V. A. Ponomarenko, "The Psychological Principles of Teaching the Man-Operator Readiness for Actions Under Extreme Conditions," VOPROSY PSIKHOLOGII, No 1, 1983, pp 23-24.

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AUTOMATION AND INFORMATION POLICY

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STATE SYSTEM OF INDUSTRIAL INSTRUMENTS, AUTOMATION EQUIPMENT

Moscow STANDARTY I KACHESTVO in Russian No 1, Jan 85 pp 19-22

[Article by V. P. Minayev, V. N. Semenov, V. M. Samoletov, A. G. Fedotov and B. A. Dyukov, the NIIStandartpribor [not further identified]; I. V. Prangishvili and S. M. Konovalov, the Institute of Control Problems of the USSR Academy of Sciences: "The Set of Standards of the State System of Industrial Instruments and Automation Equipment Is the Standardized Basis of the Development and Supply of Complete Sets of Automated Systems"]

[Text] The penetration of automation into all spheres of physical production led to the need for the significant expansion of the production and the modernization of instrument making products, the development and supply of complete sets of instruments and automation equipment for new areas of use.

At present automated systems, information processing systems and software are grouped with products for production engineering purposes. In this connection the question of the further development of the State System of Industrial Instruments and Automation Equipment (GSP)--the basis of the development and supply of complete sets of automated systems for various sectors of the national economy--has assumed particular urgency.

At the first stage the State System of Industrial Instruments and Automation Equipment was developed as a set of technical means, which are used in automated systems for the control of technological processes (TP) in case of the solution of the problems of the automatic and automated monitoring and control of production processes [1].

The scientific and technical principles of the formation of the State System of Industrial Instruments and Automation Equipment, which were formulated in the 1970's, envisaged: the division of instruments and automation equipment according to functional attributes; the minimization of the range of items of the State System of Industrial Instruments and Automation Equipment with allowance made for the meeting of the needs of industry, the development of parametric series and standard-unit complexes; the assurance of the compatibility of the items of the State System of Industrial Instruments and Automation Equipment on the basis of the standardization of signals, operating requirements and mounting dimensions [2, 3].

The base range of means of the State System of Industrial Instruments and Automation Equipment was formed during the period of 1965-1975. The hardware components of the State System of Industrial Instruments and Automation Equipment received use mainly in case of the development of automated systems for the control of technological processes for power engineering, metallurgy, chemistry, petrochemistry, the petroleum and gas industries. In recent times under the influence of the achievements of microelectronics, computer technology, optoelectronics and laser technology the set of hardware components of the State System of Industrial Instruments and Automation Equipment has been undergoing significant changes. The extensive use of programmable microprocessor control units and microcomputers as components of automated systems predetermines the need for the introduction among the hardware components of the State System of Industrial Instruments and Automation Equipment of control computers and software. The appearance of microprocessor sets of large integrated circuits ensured the production of inexpensive, reliable, small and economical microcomputers and programmable control units, which have the properties of general-purpose computers. These peculiarities of microprocessor technology are making it possible to develop qualitatively new hardware components of instrument making.

The main-modular principle of building instruments and systems, which is based on the thorough unification and standardization of the systems aspects of automation equipment--the unification and standardization on a unified ideological basis of the systems of load-carrying structures, interfaces, software, composition and stylistic decisions and the requirements of ergonomics--is finding more and more extensive use, since hardware and software, which have the properties of unitizability, are necessary for meeting the ever increasing needs for automatic and automated systems [1, 4].

The Basic Principles of the State System of Industrial Instruments and Automation Equipment. At the present stage the State System of Industrial Instruments and Automation Equipment is a set, which has been organized with respect to operation, information, power engineering, metrology and design, of means of measurement, automation equipment, control computers, as well as software, which are intended for the construction of automatic and automated systems of the measurement, monitoring, regulation, diagnosis and control of production processes, technological lines and units [5]. The means of instrument making of classes 40, 42 and 43 of the All-Union Classifier of Products (OKP), which are necessary and sufficient for the formation of the automated systems listed above, are included in the State System of Industrial Instruments and Automation Equipment.

The basic goal of the State System of Industrial Instruments and Automation Equipment is to ensure the supply of complete sets of systems as the commodity production of instrument making with the minimum expenditures on development, production and placement into operation [5].

The demands on the items of the State System of Industrial Instruments and Automation Equipment are formed by the developers of the systems jointly with the developers and producers of items of the State System of Industrial Instruments and Automation Equipment with allowance made for the maximum meeting of the demands of the users.

The management and development of the State System of Industrial Instruments and Automation Equipment should be provided with an organizational management system, a set of standard technical documents and information support, which contains data on the items being produced and the need for them.

There should be grouped with the basic systems engineering principles and methods of the formation of the State System of Industrial Instruments and Automation Equipment: unitization, the unification of the systems aspects for the assurance in advisable combinations of the necessary compatibility of items, the formation of efficient parametric series and promising ranges of items, the formation of flexible adjustable components of the systems.

The State System of Industrial Instruments and Automation Equipment as an Organizational Technical System. For the management of the State System of Industrial Instruments and Automation Equipment as a complex organizational technical system the further development and improvement of the interaction of its subsystems are envisaged (Figure 1).

The need for means of the State System of Industrial Instruments and Automation Equipment is formed in two directions:

--the first is the need of the client. In this case subsystem 1 processes the incoming thematic cards (TK) and gives assignments to subsystem 2, which carries out the necessary research, development and production of means of the State System of Industrial Instruments and Automation Equipment. After the delivery of the means to the client subsystem 2 makes an analysis of the results of their use and on the basis of this information elaborates proposals on the modernization or removal of the product from production, which are sent to subsystem 1 for the making of a decision;

--the second is the development of fundamentally new means of the State System of Industrial Instruments and Automation Equipment in conformity with the comprehensive goal programs of the development of the national economy. In accordance with the assignments of subsystem 1 subsystem 2 carries out the assignments of the goal programs and reports to subsystem 1 the results of the scientific research work and experimental design development, on the basis of which the potential clients are notified through subsystem 3 of the obtained results. The clients in conformity with the obtained information in accordance with established procedure submit information on the long-range need or the delivery volumes.

Let us examine the basic tasks of the three subsystems.

Subsystem 1 consists of the following units: a decision-making organ; a service of unification and standardization, product quality control and metrological support. For the efficient organization of the development and production of new equipment in subsystem 1 the following tasks should be accomplished:

1) the determination and correction of the goals, tasks, structure and composition of State System of Industrial Instruments and Automation Equipment;

Automation Equipment (including organizations which develop automatic and automated systems of monitoring, regulation and control).

The basic control output of subsystem 1 is the standard support of the State System of Industrial Instruments and Automation Equipment (NO GSP), which ensures the accomplishment of the tasks of the control and development of the system by standard methods, the systems engineering principles in case of the development of means of the State System of Industrial Instruments and Automation Equipment and questions of intradepartmental and interdepartmental interaction.

Subsystem 2 includes organizations, which perform basic and applied research and the development of new principles of the formation of means of the State System of Industrial Instruments and Automation Equipment, and organizations and enterprises, which develop means of the State System of Industrial Instruments and Automation Equipment. The following tasks should be accomplished in this subsystem:

1) the conducting and introduction of basic and applied research, the development of prototypes;

2) the production of means of the State System of Industrial Instruments and Automation Equipment, the evaluation of their quality, the delivery of means of the State System of Industrial Instruments and Automation Equipment to clients;

3) the development of the range of means of the State System of Industrial Instruments and Automation Equipment, on the basis of the analysis, forecasting and standardization of the problems of measurement, monitoring and control, which are being solved in the sectors of the national economy.

Subsystem 3 includes the organizations and services, which carry out the information support of the structural units of the State System of Industrial Instruments and Automation Equipment, the prompt advertising of the means of the State System of Industrial Instruments and Automation Equipment and the publication of the General Catalogue of the State System of Industrial Instruments and Automation Equipment.

The Structure of the Standard Support of the State System of Industrial Instruments and Automation Equipment and Its Interconnection With the Unified System of Standards of Instrument Making (YeSSP) and the Unified System of Standards of Automated Control Systems (YeSS ASU). The structure of the standard support of the State System of Industrial Instruments and Automation Equipment takes into account the dynamics of its development and promotes the increase of the technical level and quality of the means of the State System of Industrial Instruments and Automation Equipment. The standard support of the State System of Industrial Instruments and Automation Equipment has a three-level hierarchical structure. The composition of the standard documents of each level and the connections between the levels of the State System of Industrial Instruments and Automation Equipment, the Unified System of Standards of Instrument Making and the Unified System of Standards of Automated Control Systems are cited in Figure 2 [6, 7].

Key:

1. Unified System of Standards of Automated Control Systems
2. Set of organizational methods and general technical standards; standards of basic specifications for automated control systems (software-hardware set)
3. Requirements of general technical systems of standards; international standards and recommendations
4. Specifications for automated systems
5. Unified System of Standards of Instrument Making
6. Zero level of Unified System of Standards of Instrument Making
7. Standards of general rules, characteristics and requirements
8. First level of Unified System of Standards of Instrument Making
9. Standards for procedure of the gathering, processing and use of information on the need for measurements
10. Standard support of State System of Industrial Instruments and Automation Equipment
11. First level of standard support of State System of Industrial Instruments and Automation Equipment
12. Unified System of Standards of Instrument Making. Basic Principles (All-Union State Standard 26.207-83)
13. Organizational methods documents
14. Second level of standard support of State System of Industrial Instruments and Automation Equipment
15. Standards like the basic technical requirements and basic specifications for items of State System of Industrial Instruments and Automation Equipment
16. Third level of standard support of State System of Industrial Instruments and Automation Equipment
17. Specifications for items of State System of Industrial Instruments and Automation Equipment
18. Unified System of Standards of Instrument Making. System of Standards of Medical Instrument Making (All-Union State Standard....)
19. Standard support of medical instrument making
20. Unified System of Standards of Instrument Making. System of Standards of Scientific Instrument Making (All-Union State Standard....)
21. Standard support of scientific instrument making
22. Standard support of extrasystem instrument making

Taking into account that the State System of Industrial Instruments and Automation Equipment is the technical supply of automated control systems, the connection of the standard support of the State System of Industrial Instruments and Automation Equipment with the Unified System of Standards of Automated Control Systems is assuming particular urgency [7].

The concept of the development of this system of standards at present is examined in connection with the attribution of the systems to products of instrument making. It is envisaged that the automated systems will be

produced, made into sets and delivered to the user in accordance with the specifications as software-hardware packages (see Figure 2), which only after installation, adjustment and placement into operation at a facility of the client will appear as functioning automated control systems.

In this connection standards like the basic technical requirements for automated systems in conformity with their classification, as well as standards, which establish the composition, content and procedure of the formulation, coordination and approval of the specifications for automated systems, the nomenclature of their indicators of quality, the method of evaluation of the technical level and quality and the procedure of certification, development, placement into operation and maintenance, have been included in the Unified System of Standards of Automated Control Systems.

The demands on the hardware components of the State System of Industrial Instruments and Automation Equipment are formulated on the basis of the demands on the software-hardware packages, while the possibility of the physical implementation of some means or others of the State System of Industrial Instruments and Automation Equipment has a direct influence on the parameters of the automated systems.

The organizational methods standard documents of the first level of the standard support of the State System of Industrial Instruments and Automation Equipment should establish: the structure and algorithms of the functioning of the subsystems of the State System of Industrial Instruments and Automation Equipment; the methodology of the formation and optimization of the range of means of the State System of Industrial Instruments and Automation Equipment; the conceptual bases of the improvement and development of the State System of Industrial Instruments and Automation Equipment, the procedure of the certification of items for affiliation with the State System of Industrial Instruments and Automation Equipment.

The general technical standards of the first level are aimed at ensuring the compatibility of items of the State System of Industrial Instruments and Automation Equipment and establish: the system of general technical demands on the means of the State System of Industrial Instruments and Automation Equipment; the groups of operating conditions; the nomenclature and means of the standardization of metrological characteristics; the demands on load-carrying structures, interfaces, connections with pneumatic and gas, optical fiber and other communications lines; the requirements of technical esthetics and ergonomics.

The decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy" envisages: the formulation of state standards like the basic technical requirements (or basic specifications) for similar groups of products, which contain, along with the demands on the quality of the output being produced, demands on equipment which is being modernized and newly developed. Therefore, the second level of the standard support of the State System of Industrial Instruments and Automation Equipment includes standards like the basic technical requirements and basic specifications, which establish the demands on the means of the State System of Industrial

State System of Industrial Instruments and Automation Equipment, moreover, within the individual programs of complete standardization standards, which are included only in the second and third levels, are formulated for the most important groups of similar products.

It is advisable to settle the questions of metrological support at the first level of the standard support of the State System of Industrial Instruments and Automation Equipment, which will make it possible to pursue a unified policy in the area of the methods and means of testing and checking the means of the State System of Industrial Instruments and Automation Equipment and to ensure the comparability of the results on the basis, for example, of a sectorial unitized set of metrological means.

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COMPUTER-AIDED DESIGNING, ENGINEERING, PREPARATION OF PRODUCTION

Moscow VESTNIK VYSSHEY SHKOLY in Russian No 5, May 85 pp 29-31

[Article by Professor Yu. I. Topcheyev, chairman of the Scientific Methods Council for the Automation of Designing of the USSR Ministry of Higher and Secondary Specialized Education: "Everyone Should Be Able to Use Systems of Computer-Aided Designing, Engineering and the Technological Preparation of Production"]

[Text] The introduction of flexible manufacturing systems and robots in industry and agriculture and the complete automation of production, which are envisaged by all-union programs, are impossible without the use of systems of computer-aided designing, engineering and the technological preparation of production (SAPR). The use of SAPR makes it possible to unite in a single cycle the performance of planning and design work and technological preparation with the minimum number of documents or their complete absence. Having been implemented at enterprises, such a production cycle improves the working conditions of designers and workers, frees them from the performance of routine operations and thereby affords greater opportunities for creative activity.

It is well known that by means of flexible manufacturing systems it is possible without changing the machine tool equipment on the same flow line to produce up to 1,000 different parts by the reorganization of the work program on computer. In case of the automation of the processes of welding and assembly the use of such systems will make it possible to produce without any involvement of man about 50 types of items. While the work programs both for flexible manufacturing systems and for robots are developed by the methods of SAPR.

One should also group with the substantial merits of SAPR the fact that the elements of the software, which are recorded on magnetic devices, can be copied and used at different enterprises in case of the development of new types of products, which decreases substantially the cost of the process of engineering. Moreover, the number of engineers and technicians is reduced, the consumption of power and materials declines, and transportation costs also decrease.

The specialist, who is able to use the methods of computer-aided designing and engineering, chooses the most efficient design solutions, which increase the technical level of the output being produced. Here the time of designing is reduced to one-third to one-half and, consequently, the placement of items into series production is hastened. The design documents are prepared with the aid of a computer 50- to 80-fold more rapidly than in case of manual execution and, moreover, with a higher quality and without errors. In case of the use of nondocument technology (in case of the use of flexible manufacturing systems) the labor productivity of the designer increases by 100-fold and more. The utilization of computer technology also increases considerably, since several planners can work simultaneously on one computer.

The most important merit of SAPR is the possibility of developing a unified statewide database, which both engineers and technicians in case of the designing of new items and graduate and undergraduate students during training can use (to the full extent by means of personal computers).

Of course, the extensive use of SAPR in the national economy, scientific research and the educational system is impossible without the specialized training and further training of personnel in the area of SAPR. In reality, it is a question of the formation of highly skilled specialists of a new type, who are able to use both traditional preliminary estimation methods and computer-aided design methods.

It must be said that such training of specialists has already begun. Developers of SAPR, developers of software for these systems, developers of the hardware of SAPR and, finally, the broadest category of specialists--users of SAPR (in accordance with the basic specialties and specializations of engineering higher educational institutions) are being trained. Of course, it is impossible to carry out the training of developers and users of SAPR without an orientation to specific sectors of the national economy. The training of such personnel for machine building, power engineering and the electrical equipment industry, ferrous and nonferrous metallurgy, construction and the construction materials industry, the mining and chemical industries, electronic engineering and computer technology, automation equipment and instrument making, rail and motor transport, light and the food industries and agriculture has now already been organized.

What basic demands are now being made on specialists in SAPR?

The developers of SAPR (these are specialties 0608, 0646 and 0656, which give the qualification of a systems engineer) along with training in computer mathematics, systems programming, the architecture of computers and the formation of databases should acquire knowledge in their subject areas and know how to develop specialized computer systems.

The developers of the software of SAPR (specialty 0647, the qualification of a mathematical engineer) should have thorough knowledge in the area of computer technology, programming in ASSEMBLER and high level languages, operating systems, databases and information theory; moreover, they should know how to develop specialized operating systems and dialogue languages for the organization of the interface of the designer with the computer system, as

well as be able to use the methods of the optimization of planning and design decisions.

The developers of the hardware of SAPR (specialty 0648, the qualification of a design and process engineer) should have thorough knowledge in the area of hardware, computer technology and electronics and should know how to design computer peripherals, means of the interfacing of personal computers with general-purpose computers, as well as specialized systems of the checking of the hardware of SAPR.

The engineers who are users of SAPR should acquire, on the one hand, a traditional planning and design training and, on the other, the ability to use computer-aided design systems in the dialogue mode with computers and to work out packages of applied programs for their subject area.

The organization and carrying out of the training of specialists, who are able to use SAPR, are a complicated matter. Generalizing the experience of the higher educational institutions which for several years now have been performing this work, it is possible to formulate a number of conditions which to a certain degree ensure success.

First of all there is the constant contact of students with computers during the entire period of their training at the higher educational institution. The quantitative parameters here are as follows. For the training of engineers who are users of SAPR it is necessary to envisage not less than 70-80 hours of computer time; the developers of SAPR, their software and hardware should have 120-140 hours of computer work.

Consequently, the methods of teaching a large number of general educational and general engineering subjects require fundamental updating in order to ensure the use of computer technology in it. Thus, it is necessary to conduct the classes in engineering graphics and descriptive geometry on the basis of the use of computers, which make it possible to carry out all the geometrical constructions automatically by means of plotters. In the courses of theoretical mechanics and the strength of materials the essence of the methods of plotting the curves of velocities, accelerations, shearing forces and moments should be explained to the students only in a few classes, and then the standard algorithms, in accordance with which graphs can be plotted for real designs, and not for simplified models (the future engineer will never encounter them in his practical activity), should be cited. It is advisable to conduct according to a similar method the classes in electrical engineering, electronics, the theory of automatic control and so on.

As for physics, chemistry, materials science and several other subjects, it is very important to organize the teaching so that along with the study of real physical and chemical processes the students would formulate algorithms of the determination of the basic data of these processes.

All this means that the instructors of general technical and general engineering subjects should know well the methods of formulating work programs in modern algorithmic languages and be able to conduct lessons in display classrooms. It is possible to ensure this only by the consistent further

training of instructors either at faculties of skills improvement or within the system of studies, which has been specially organized at every higher educational institution. Experience shows that for instructors of the noncharacteristic chairs 70 hours are required for this, for characteristic chairs--250 hours.

The good material equipment of higher educational institutions is very important for the sound training of students in the area of SAPR. Display classrooms are undoubtedly necessary; at present they are usually equipped with three types of computers--the SM, YeS and Elektronika series. In case of the training of designers automated workplaces (ARM's) are also used. True, the industrial automated workplaces based on SM-3 and SM-4 computers, which are used at higher educational institutions, have small volumes of working storage and do not ensure the simultaneous work of more than two students. The new SM-1420 computer, which enables 16 students to work simultaneously in the display classroom, has far greater possibilities. However, automated workplaces with these computers will not begin soon to arrive at higher educational institutions in large quantities. Therefore, higher educational institutions have to develop automated workplaces themselves on the basis of the unified system of electronic computers or to use the SM-4 two-computer complexes.

Here, as experience shows, the successful work of several users can be ensured by the development of specialized programs. For example, for this purpose the GRAF/SM system is being used at the Moscow Aviation Institute, SAGRAF and GRAFOR--at the Moscow Engineering Physics Institute, DISGRAF--at the Far Eastern University. However, it has to be admitted that the use at higher educational institutions of different types of specialized systems of computer graphics complicates the use here of the packages of applied programs, which have been developed by industry, for the automation of the processes of engineering and the technological preparation of production.

The instruction in the methods of SAPR in the lower-level courses at many higher educational institutions is carried out in display classrooms with small computers like the Elektronika. BASIC and its different versions are used as the algorithmic language. As a rule, the computers of this class afford quite adequate opportunities for the study of the methods of SAPR in classes on such subjects as engineering graphics and descriptive geometry, theoretical mechanics, the strength of materials, electrical engineering and electronics.

At present the development of new types of computer systems on the basis of several microprocessors is one of the promising directions. Multiprocessor computers have ultra-high speed and large volumes of memory, and the use of these computers for the automation of designing and engineering affords users practically unlimited possibilities. The programs for these computers are written in Pascal and Ada. It is possible to assume that these languages in the immediate future will become the basic ones in the higher school.

The teaching of special subjects in display classrooms makes it possible to organize the lessons in the following manner: one group of students carries out the designing of individual parts of a different type, another group

assembles several blocks from them, while a third group carries out the determination of their basic characteristics (the calculation of the gaps in circuits, the finding of the degree of wear of parts subject to the operating time and so on). Then the groups change places. As a result all the students study the processes of the engineering of parts and the designing of blocks and make the necessary theoretical calculations. Such a method increases appreciably the efficiency of the use of computer technology.

In conclusion a word about the most significant difficulties, with which the technical higher educational institutions, which are carrying out the training of specialists in the area of SAPR, are faced. First of all one should point out the slow pace of the introduction of standardized operating systems which provide efficient means of work with packages of applied programs in the dialogue mode. Most often each higher educational institution develops its own specialized operating system which is oriented toward the handling of specific packages. As a result of this over 800 packages of applied programs, which were developed at higher educational institutions and on the writing and debugging of which a very large amount of time was spent, can be used only where they were developed.

Another thing is that the higher school needs an information service for the programs of SAPR. It seems that the time has come to set up at one of the base higher educational institutions a cost accounting organization for the gathering and dissemination of programs. It will, first, ensure the circulation of the programs of SAPR and, second, publish catalogues of the packages of applied programs, which are used at higher educational institutions.

There are still too few textbooks on SAPR, which is complicating the process of training and instruction. It is necessary to increase the standards of the maintenance of computer technology at higher educational institutions.

The rapid elimination of these shortcomings will make it possible to increase the efficiency of the use of modern computer technology and to increase the number of specialists in SAPR in conformity with the increasing needs of the national economy.

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PROBLEMS OF AUTOMATION IN KAZAKH INDUSTRY

Alma-Ata NARODNOYE KHOZYAYSTVO KAZAKHSTANA in Russian No 4, Apr 85 pp 31-35

[Article by Candidate of Technical Sciences D. Mukanov, director of the Special Planning and Design Bureau of the Chermetavtomatika Scientific Production Association: "Automation: Problems of Development and Introduction"; passages rendered in all capital letters printed in boldface in source]

[Text] The improvement of production technology, the changeover to new highly productive continuous flow production processes, the increase of the demands on product quality--all these factors are making automation the most important direction of technical progress. Therefore, the task of making the achievements in the area of automation accessible to practice remains urgent.

Unfortunately, the introduction of scientific developments at times continues for a long time, some of them are not implemented at all. This occurs because the "life" of new equipment to obsolescence in our times does not exceed 6 years. The path from an idea to its implementation in production frequently extends for decades. Here it turns out that technical decisions become obsolete, as a result some scientific collectives work for years without a practical return. At times a scientist is able at the cost of enormous efforts to develop a prototype, but it does not "take root" at a works because its thorough design and technological study was not carried out in due time, as a result of which the new equipment proved to be inconvenient for use.

I will tell about the experience which was gained by the collective of the Special Planning and Design Bureau (OPKB) of the Chermetavtomatika Scientific Production Association of the USSR Ministry of Ferrous Metallurgy in the elimination of the difficulties of introducing new equipment in production.

The Special Planning and Design Bureau produces annually over 20 descriptions of instruments, means and systems of automation, of which there is no analogue in the country. Here work is being performed in new scientific and technical directions: nuclear physics and mass spectrometry, the theory of information and reliability, metrology, automated electric drive, as well as the automation of metallurgical processes on the basis of computer technology. In accordance with the results of research in recent years alone 28 highly efficient means and systems of automation have been developed and their

production has been assimilated. In ferrous metallurgy of the country and abroad--in Turkey, Pakistan, Nigeria, Bulgaria, Poland and others, hundreds of units of means and systems of the batching of charge materials, the regulation of the temperature-speed conditions of rolling, the tensioning of steel strip, the composition and consumption of converter gases and others are operating successfully. During this period 132 certificates of authorship and 4 patents were obtained and over 300 scientific articles and pamphlets were published.

A coordinated detachment of scientists, engineers, designers and workers in accordance with a common plan, which is aimed at common ultimate indicators, is developing high-precision, complicated electronic instruments and computer technology, which conforms in its characteristics to the best world models. The neutron moisture meters of blast furnace coke and iron ore concentrate with automatic calibration and the gas calorimeters, which were introduced at the Magnitogorsk and Karaganda metallurgical combines, the Kostomuksha Mining and Ore Dressing Combine and the Chelyabinsk Metallurgical Plant, by right are the most valuable developments of last year. The economic impact from their use exceeded 5 million rubles. The use of our developments is enabling metallurgists to improve technological processes, to save annually 20,000 tons of blast furnace coke and more than 30 million kWh of electric power and to increase the output of metal products.

The collective of the bureau is constantly taking part in the work of international scientific and technical conferences and exhibitions. Our instruments have been displayed more than once at the exhibitions of USSR and Kazakh SSR national economic achievements and exhibitions of the creative scientific and technical work of young people, scientific and technical societies and the All-Union Society of Inventors and Efficiency Experts. The fuel moisture meters, the batching systems, the root-mean-square current meters and so on have been commended by gold, silver and bronze medals of the Exhibition of USSR National Economic Achievements and certificates of exhibitions.

At present scientists of the Special Planning and Design Bureau are taking part in the formulation of the Comprehensive Program of Scientific and Technical Progress of the Kazakh SSR for 1990-2010 and are studying the prospects of the development of the automation of technological processes of metallurgical production in the republic, the development of automated systems for the control of technological processes on the basis of minicomputers and microprocessors and the use in metallurgy of laser optoelectronic equipment.

The work on the development of automated systems for the control of the technological processes of the production of sinter, pig iron, steel, rolled products and tin plate merits special attention.

The implementation of research is being accomplished in a short time. For example, the research, development, production and introduction of 26 systems of the automatic batching of components of the agglomerated charge at the Karaganda Metallurgical Combine were completed in 1.5 years.

How is it possible in the shortest possible time to "materialize" our ideas and accomplish their "registration" at a works? The point is that the Special

Planning and Design Bureau is a combined organization and contains within it, along with scientific divisions, design and planning subdivisions, a mock-up division and a pilot plant of the instrument making type. Moreover, a specialized start-up and adjustment administration with sections in Temirtau, Magnitogorsk, Lipetsk, Cherepovets and other regions of the country is subordinate to us. Such a structure makes it possible to perform the entire set of operations from research and designing to the small-series production of systems of automatic machines.

In the Special Planning and Design Bureau the scientific idea as if in a relay race moves from the researcher to the developer, further to the designer, the process engineer and the worker of the pilot works. In close contact they seek valid technical solutions and means of their implementation. Incidentally, the workers are stimulated materially in accordance with the results of the introduction of the development in case of the obtaining of a real economic impact.

The establishment of planning subdivisions makes it possible by the moment of the completion of the experimental design work to have documents for the performance of installation, start-up and adjustment operations, which shortens on the average by 4-6 months the time of the placement of our developments into use. The organization of a special subdivision for the performance of start-up and adjustment operations also led to the acceleration of the introduction of new equipment and increased its operating reliability.

In short, so that in the shortest possible time a scientific idea would become accessible to practice, substantial changes in the structure of scientific research and planning and design institutes are needed. Pilot experimental and other engineering services should be organized within them. Under present conditions it is necessary to do this by the consolidation of promising subdivisions and the cutting of inefficient ones. This is all the more important since not every worker of a scientific research institute is a scientist or developer. If they are used in engineering and experimental work, everyone will stand to gain.

Introduction is the crowning point of scientific and technical progress. The scientist knows about this and always strives for this. At the same time the potential of scientific organizations for the present is being used poorly. There are many factors which prevent an innovation from being assimilated in the shortest possible time. For example, a dispute of long standing is taking place at the "boundary" between institutes and enterprises. Scientists complain of production workers, who, they say, do not want to bring their ideas up to practical implementation. Specialists of enterprises in turn believe that science frequently proposes unfinished research. Indeed, the necessary experimental checking of the ideas and designs, which arrive at the works, is not always ensured. As a result the majority of developments conclude with a work on paper and the making of a mock-up or prototype and do not find the way to enterprises. There is a way out of the formed situation. Institutes, design bureaus and higher educational institutions should actively, as they say, having rolled up their sleeves, set to work on the establishment of their own design and experimental production bases. Without this they will not be able to turn over to industry reliable, durable,

economical products. I will cite one everyday example. If they invited each of us to purchase a car or television, but with the condition that at home we would have to finish them, finish making them up and bring them up to working order, apparently, we would reject such a purchase. But if you seriously consider the causes of the existing disputes of science and production, they reduce precisely to this. Every collective is simply obliged to deliver its products "turnkey."

The executives of scientific institutions can do much on the strengthening of the design and experimental bases, but they cannot do without the assistance of industrial enterprises. But this assistance will come to them, if the themes of institutes are coordinated with the needs of the region. Enterprises will see science in "work clothes," if it develops the needed, fundamentally new equipment and advanced technology on a real-time scale.

Cooperation with industry is of great importance for speeding up the process of introduction. We are obliged to the specialists of the blast furnace shop of the Krivoy Rog Metallurgical Plant for the fact that we were able in a short time to develop and check under industrial conditions, for example, a range of neutron moisture meters. The management of Agglomerate Factory No 2 of the Karaganda Metallurgical Combine created the necessary conditions for the assimilation in 3 months of a set of automatic batching systems. Moreover, it occurred under the conditions of operating production. As a rule, experienced workers become allies in case of the introduction of new equipment, if they are convinced of its utility and efficiency and see that the use of the innovation will not require the attraction of additional service personnel.

Central plant laboratories (TsZL's), central laboratories of automation and mechanization (TsLAM's), design bureaus and others should become a kind of bridge between science and production. In our oblast there are many examples of when the workers of central plant laboratories and central laboratories of automation and mechanization work independently on important scientific and technical problems. Thus, the collective of the central plant laboratory of the Karaganda Metallurgical Combine made a large scientific contribution to the assimilation of the comprehensive technology of the production of tin plate from high-phosphorus ores, which was used for the first time in domestic practice.

However, the conditions for the increase of their role in the acceleration of scientific and technical progress are still not being created everywhere. But meanwhile the demands of the day are that plant scientists and designers in business contact with colleagues of scientific research institutes, design bureaus and higher educational institutions would elaborate the vital problems of production and would think about its future. They can do especially much at the final stages of the introduction of the results of scientific research. Plant science should be transformed from a secondary service into a creative partner of large-scale science, it is difficult to overestimate the return from this alliance.

There is another matter in the way of speeding up the "research--production" process. In our times it is possible to carry out major scientific and

technical developments and to organize their extensive introduction only by the forces of scientific research institutes and design bureaus of different types. We believe that the conclusion of multilateral contracts on scientific and technical cooperation between scientific organizations and enterprises of the republic in case of the fulfillment of specific themes merits all kinds of support.

Let us take, for example, the obtaining of tin plate at Kazakhstanskaya Magnitka. The complex was put into operation and hundreds of tons of tin were sent to clients. But there are still many unsolved problems, because the works is really unique and should put out products of the broadest assortment. The successful solution of the problem will require the participation of a large detachment of chemists, physicists, metallurgists, automation experts and other specialists. IN OUR OPINION, THE REPUBLIC SCIENTIFIC AND TECHNICAL PROGRAM "KAZAKHSTAN TIN" SHOULD BE FORMULATED, THE SPECIFIC AMOUNTS, TIMES AND CONTINGENT OF ALL INTERESTED ORGANIZATIONS SHOULD BE SPECIFIED.

Today scientists and designers, in spite of their departmental subordination, do not have the right to keep aloof of the topical problems, in the solution of which their assistance is needed. Departmental barriers are not always conducive to the participation of many scientific research institutes and design bureaus in the solution of regional scientific and technical problems. Therefore, the establishment of the Central Kazakhstan Department of the Kazakh SSR Academy of Sciences will enable the scientists of Karaganda to overcome many difficulties.

I want to dwell specially on one of the problems. It is a question of the use of computers. About 100 enterprises, mines, organizations of motor transport, construction and trade and institutes have such equipment. However, closer acquaintance with the efficiency of the use of computers at several of them gives one the right to say that the expensive, for the present still very scarce computer is being poorly utilized. Of course, the same departmental approach: it is inefficient, but one's very own, tells here. Some of the managers for some reason mechanically identify the availability of a computer with an automated production control system, although when it came to the test it turns out that in connection with the lack of information support and software the computer is used only as a large adding machine for the making of various kinds of economic planning calculations and the calculation of wages. One should also speak about the fact that a large staff of service personnel is engaged in the maintenance of each computer. THE WAY OUT OF THIS SITUATION CONSISTS IN THE ESTABLISHMENT OF LARGE COLLECTIVE-USE COMPUTER CENTERS AND IN THE USE OF THE COMPUTER BEING FREED AND THE INTELLECTUAL FORCES FOR THE AUTOMATED MANAGEMENT OF THE SERVICES OF MUNICIPAL SERVICES, PUBLIC DINING, TRADE, SCIENTIFIC RESEARCH AND PLANNING AND DESIGN ORGANIZATIONS.

The use of systems for the automation of design work (SAPR's) is an effective lever of the shortening of the time of the study of developments and the production of new equipment. But not every organization and institute, enterprise is capable of this work. THE WAY OUT OF THE SITUATION IS ALSO SEEN IN THE ESTABLISHMENT OF COLLECTIVE-USE SYSTEMS FOR THE AUTOMATION OF DESIGN WORK. Without modern computer technology, without software it is impossible to manage a modern enterprise competently and efficiently and to develop new

equipment which satisfies the multilevel requirements of today. Therefore, the available equipment should be used practically, in the interests of the region.

The processes of the assimilation of new technology and equipment and automation systems and their further improvement with allowance made for the constantly increasing requirements are inconceivable without thorough research and experiments under industrial conditions. ALL THIS REQUIRES THE CREATION OF A ZONE OF SCIENCE AND TECHNOLOGY AROUND, FOR EXAMPLE, THE KARAGANDA METALLURGICAL COMBINE, WHICH CONSISTS OF A NETWORK OF SCIENTIFIC RESEARCH AND PLANNING AND DESIGN ORGANIZATIONS WITH AN EXPERIMENTAL WORKS. Practical experience testifies to the necessity of such a solution. A graphic example is the Karaganda Coal Production Association, which now holds a leading place in the sector. The role of local institutes in the fact that it has high and stable technical and economic indicators, in spite of geological mining conditions which are becoming more difficult with the years, is great.

The production potential of the republic is increasing rapidly. During the 11th Five-Year Plan alone hundreds of new enterprises will be put into operation. The scientific and technical problems of the industrial complexes being put into operation will be solved with the proper efficiency and thoroughness only with the participation of local scientific and technical organizations. THEREFORE, IT IS NECESSARY TO DEVELOP ZONES OF SCIENCE AND TECHNOLOGY AT EVERY TERRITORIAL PRODUCTION COMPLEX: THE PAVLODAR-EKIBASTUZ, MANGYSHLAK AND KARATAU-DZHAMBUL COMPLEXES. THIS IS A COMMAND OF THE TIMES. Without the stable link-up of science and production the prospects and reserves will be used far from completely.

The party and government are devoting particular attention to the increase of labor productivity in the national economy by the introduction of automatic manipulators and robots, and first of all in those sections in which up to now the proportion of difficult manual labor is large and there are not enough skilled personnel.

The work in the region on the introduction of industrial robots has been performed in an obviously inadequate amount. During recent five-year plans new enterprises with modern equipment and technology have been put into operation, a large amount of work has been performed on the renovation of production sections and shops. Automated and mechanized lines based on industrial robots should have appeared at them. In practice this did not happen. Even at such an object, which today continues to be built--at the plant of industrial rubber items (Saran)--the proportion of manual labor is large. Here hundreds of working women carry out very simple technological processes, which it would be entirely possible to entrust to automatic manipulators. Such, too, is the situation at other enterprises of the oblast: alongside highly productive equipment it is possible to see a worker with a sledge hammer, a shovel, a wheelbarrow and so on.

All economic managers and specialists understand perfectly that sooner or later they will have to engage in the introduction of industrial robots, for without them it is impossible to increase from year to year the output of high quality products in a large volume under the conditions of a shortage of

personnel. And all the same many of them are striving today to spend time on complicated equipment which at times requires much trouble. For it is necessary to start literally from scratch. Here and there they are planning to test during the entire five-year plan only one model of a robot. The reasons for such a position are different: there are no monetary assets, there are not enough specialists or the equipment is unreliable, while in the region there is no specialized organization for introduction and so on. In a number of cases it is impossible not to agree with these conclusions. But all the same the protracted familiarization with robots should be explained first of all not by objective factors, but by inertia and the conventional approach to the introduction of new equipment.

The interests of the matter require a different approach--during the 12th Five-Year Plan it is time to give a work permit to robots, having made them our reliable allies.

The use of laser, electrochemical, plasma, radiation and other efficient methods of working metals, materials and items has received extensive recognition in the country. They make it possible to improve the quality of the output being produced and to cut down significantly the expenditures of manpower, material and energy resources. But these methods have also not received proper dissemination at enterprises. Of course, it is possible to explain such a situation by the lack of initiative of economic managers. In the flow of everyday matters they do not always seek fundamentally new reserves of the increase of production efficiency. But first of all the scientists of higher educational institutions and scientific research institutes should be "disturbers of the peace" and champions of the introduction of everything new that domestic science produces. It is also the fault of the large detachment of scientists of the region that the achievements of science and technology are being assimilated very slowly at industrial enterprises. The scientific themes of institutes still do not completely meet the needs of republic industry, there are cases when the results of many years of research find application not locally, but "far, far away." Local scientists at times set to work without proper boldness and persistence on the development and creation of a scientific research in the modern scientific and technical directions, which production workers will need so much already tomorrow.

No, the suggestion that scientific research institutes, design bureaus and chairs of higher educational institutions in case of the choice of a scientific problem proceed first of all from the interests of their area, was dictated not by considerations of regionalism. REGIONAL SCIENCE, IN SPITE OF ITS DEPARTMENTAL ISOLATION, SHOULD TAKE INTO ACCOUNT LOCAL INTERESTS, MOREOVER, MANAGEMENT SHOULD ENCOMPASS THE STAGES OF THE CHOICE OF THE THEMES OF SCIENTIFIC RESEARCH, THE COORDINATION OF THE OPERATIONS, WHICH ARE PERFORMED BY THE EDUCATIONAL INSTITUTES, SCIENTIFIC RESEARCH INSTITUTES AND DESIGN BUREAUS OF VARIOUS MINISTRIES WITHIN ONE SCIENTIFIC AND TECHNICAL PROBLEM, AND THE INTRODUCTION OF THE RESULTS OF THESE OPERATIONS IN THE REGION.

At the December (1983) CPSU Central Committee Plenum tasks on the efficient use of material and manpower resources and the saving of metal, fuel and

electric power were urgently posed. On this level in the republic there are many unsolved problems. The main trouble is the lacking of equipment for obtaining primary information on the physical chemical parameters of the raw materials being processed and the finished product, the ash content and granulometric composition of fuel, the temperature and speed of the occurrence of technological processes. The scientists of the institutes of the Kazakh SSR Academy of Sciences, at which there are excellent scientific forces, are entirely capable, in our opinion, of developing such sensors. However, it should be noted that the potentials of the scientists of academic institutes and educational institutions of the republic for the present are being used far from completely. Much organizational and technical work on the strengthening of their contact with production, which, undoubtedly, will make it possible to use the scientific potential more efficiently, will be needed.

And about another reserve. Many institutes and design bureaus still report back, by citing the figures of the conditional economic impact (and in millions of rubles!) and the conditional freeing of workers from the conditional (!) introduction of their own work. Let us face it, frequently after the authors leave a project, the new equipment in general ceases to work, they even forget about it at enterprises. But institutes continue for a long time yet to promote these innovations in reports and publications, which leads to the broadening of the geography of the introduction of experimental, single models which have not justified themselves in practice. As a result given the large expenditures the practical return is small. A specific conclusion suggests itself. IT IS NECESSARY TO EVALUATE THE WORK OF SCIENTISTS AND OF SCIENTIFIC COLLECTIVES AS A WHOLE ACCORDING TO THE DEGREE OF THE PRACTICAL ASSIMILATION OF THEIR SCIENTIFIC PRODUCT IN THE NATIONAL ECONOMY.

The prestige of a scientist in our country is great, the respect for him is great, but his status should also depend on "production" certification. This measure, incidentally, just as many others, should force the collectives of scientific research institutes and design bureaus to give more attention to production.

The acceleration of scientific and technical progress also requires the enlistment in this work of social scientists: economists, sociologists, psychologists. Their involvement will make it possible to solve on a scientific basis many economic and sociopsychological problems and will help scientists of technical specialties to analyze in good time and to find means of overcoming the difficulties, of which there are many on the thorny path of the assimilation of new equipment and advanced technology.

It is the command of the times to eliminate everything that hinders the process of introducing new equipment and means and systems of automation. And we, the workers of science, should take the first steps in this direction. Our products, which are delivered to the works, should be reliable and vitally necessary to production.

7807
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NEW SCIENTIFIC-TECHNICAL BULLETIN PUBLISHED

Moscow Television Service in Russian 1430 GMT 9 Jun 85

[From the Vremya newscast; announcer-read report over video]

[Summary] A new bulletin, entitled "Scientific-Technical Revolution: Problems and Solutions," has been published by the Znaniye Society. [Video shows first issue, apparently tabloid-sized; with words "published three times a month" beside masthead.]

One of the articles in the first issue concerns the work of the Institute of Crystallography at the USSR Academy of Sciences, where hard crystals have been obtained for use with technological lasers. They can be built into any machine tool for working metal. Experts have called this model "laser attachments." [Video shows still from newspaper, then a "laser attachment" in action, cutting metal.] The laser easily cuts refractory metals: for example, the laser scalpel can cut through half a meter of stainless steel in 1 minute. I. S. Nayashkov, chairman of the USSR State Committee of Inventions, said that this is an example of the new technology that Soviet industry needs so badly today. The new eight-page bulletin will acquaint readers with the most topical questions of the day: problems of economics, fundamental research, applied research.

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PATENTS AND INVENTIONS

INDUSTRIAL PATENT PROBLEMS DESCRIBED

Tallinn TEHNIKA JA TOOTMINE in Estonian No 5, May 85 pp 23-24

[Article by M. Eelmae and M. K. Summa, "Mistra" Fabric Textile Scientific and Production Collective of Tallinn: "Experiences and Problems of a Firm's Patent Office"]

[Text] One of the most important indicators of effective research is the creation of legally protected, purely patented, and economically widely accepted technical solutions. The solution of this problem depends greatly on the management of information, invention, patents and licenses. Increases in the technical level and effectiveness of scientific work are possible only when the requirements of government standard GOST 15.011-82 are met, i.e. when thorough patent research is carried out at the major stages of research.

In the "Mistra" collective pre-project patent searches have been implemented in research, as well as the assessment of patent situation at the conclusion of the project. Research into new instruments and technological processes cannot be included in the plans without a certificate regarding patent searches. For every topic the patent office establishes a survey card of the decision regarding authorship certification for the invention, the protection of the invention abroad, and the application of the invention in the national economy. A collective-wide standard for patent research is in the process of approval.

Unfortunately, following the stipulations of GOST 15.011-82 regarding business research and patent situation is quite difficult for our republic's light industry. Awareness of trends in the light industry of other countries is hampered by a lack of a republic-wide cabinet of firms. This could arrange for traveling exhibitions to demonstrate the holdings of its all-union counterpart cabinet, doing so with the ESSR Palace of Trade and Industry.

Of great importance in raising the level of solutions in our collective is the effective patent information. At this time the collective's patent collection includes 25,944 invention descriptions. The patent collection is compiled on the basis of informative, normative, and methodological patent information. Since "Mistra" is a subscriber of the republic's automated science and technical selective information system VALTER, it also makes use of the "Poisk" collective's INPADOC-POISK data bank. The latter's info transmission is satisfactory, but many of the ordered invention descriptions are of poor quality.

In establishing and using a patent collection the information apparatus cannot be overlooked. The collective's patent office has established six files within its patent collection:

1) A catalog of domestic and foreign invention descriptions;
2) Patent information reference catalog regarding machines and technologies used in producing non-woven materials in the USSR and the leading capitalist countries, and minor mechanization machines used in the clothing industry;
3) A catalog of light industry industrial samples;
4) A file of patent owning firms and of patent-analogs;
5) A catalog of authorship certificates issued to workers of the collective;
6) A file of inventors working in the collective.

Unfortunately, patent searches, patent purity, and preliminary evaluation of innovations are hampered by the republic patent collection's cramped space and operating methods that leave something to be desired. Descriptions of inventions made in developed industrial countries have been filed not according to subject but by numbers, for some time invention descriptions of several states, such as GDR, have not been ordered, etc.

One of the basic tasks of our patent office is to determine which technical solutions are at the standard of an invention, and then secure legal protection for them. To date workers of the collective have received 66 authorship certificates. For orderly invention activity and to increase the economic effect of an invention's implementation we compile an annual plan regarding probable inventions and their implementation. The plan list the department where the solution was obtained, and stipulates the deadline for submission of application materials. In compiling the plan attention is paid to the connection between technical solutions and research in progress. Last year the number of invention application increased 22 percent over 1983.

After the implementation of the new law regarding industrial samples which makes legal protection of the configuration of products of the light industry possible, we have been dealing with that as well. Last year we submitted 24 applications for industrial sample certificates. More than 40 industrial sample certificates have been issued to "Mistra" workers. In the interest of rapid preliminary evaluation and for determination of analogs the collective's patent office compiled a catalog of industrial samples of the light industry that are protected in the USSR and other developed industrialized countries.

Since our collective coordinates the invention and patent activity in the ESSR light industry, it was charged with methodological guidance in that area. Here, however, the republic patent collection must once again be criticized, since its film file has an insufficient amount of production samples from developed industrialized countries. Legal protection of the outward form of light industry products requires more attention and in this area a great amount of work waits for the "Mistra" patent office.

As far as the new carpet patterns created in the collective are concerned, most of these are protected with a product sample certificate. In recent

years the collective's artists have worked with great creative enthusiasm. Several original patterns have been created that have won union-wide acceptance and have been introduced into mass production.

We also pay great attention to trade marks. In "Mistra" the custom of protecting solutions with a verbal trade mark has been established. The verbal trade marks of the collective's production have helped to differentiate "Mistra" solutions from others, have brought us a firm body of customers, and served our good reputation. For this reason all carpets of the collective have verbal trade marks. The "Mistra" carpet has also industrial production, a certificate from the World-wide Intellectual Property Organization. The "Mistra-taft" carpeting is protected by a trade mark and several industrial sample certificates. We also received a verbal trade mark certificate for the "Sumus" and "Elmod" technological processes. The collective has a total of 21 trade marks, 20 of these are verbal.

The internal collective socialist competition reckons with contributions to technical creativity. This has markedly accelerated technological creativity. Along with the cells of TTU [Scientific-Technical Society] and the ULRU [All-Union Rationalization Society] we stage several competitive inspections every year. We determine the best invention, rationalization suggestion, inventor, rationalizer, young technological innovator, female innovator, industrial sample author, and rationalization suggestion regarding work safety.

Finally, another problem. Up to now no internal contracts have been concluded regarding skill information, but in the interest of accelerating technological progress we deem that to be desirable. Contract regarding process information would increase the interest of the authors in transferring the fruit of their labors to other firms, and would guarantee author control in the production. Currently this is lacking.

The patent office of the collective sees its main mission in the next few years in securing comprehensive legal protection for every technical solution arrived at in the collective, i.e. in applying for authorship certificates, and certificates for industrial samples and trade marks.

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CEMA COOPERATION IN DEVELOPMENT OF SCIENCE, TECHNOLOGY

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 4, Apr 85 pp 26-32

[Article by Academician Stanislav Yemelyanov, director of the International Scientific Research Institute of Control Problems: "The Intensification of Production and the Management of Scientific and Technical Progress"]

[Text] The present stage of the economic development of the countries of the socialist community is characterized by the implementation of the policy of the all-round intensification of social production and the increase of its efficiency. This policy, which was specified by the fraternal Communist and workers parties, is intended for the long-range historical future.

Among the main directions and factors of the intensification of production a decisive role belongs to scientific and technical progress (NTP). In this connection today the role of science and technology and of the extensive and rapid introduction of their achievements in the national economy has increased drastically. The growth rate of the productivity of national labor and the national income and the amount of material wealth, which the countries can use for the implementation of their own socioeconomic programs, depend on the solution of this problem.

The acceleration of scientific and technical progress has become a fundamental direction of the economic policy of the CEMA member countries. "Intensification, the rapid introduction in production of the achievements of science and technology, the implementation of major comprehensive programs--all this in the end," as was emphasized at the Extraordinary February (1984) CPSU Central Committee Plenum, "should raise the productive forces of our society to a qualitatively new level."

The tasks facing the fraternal countries in the acceleration of scientific and technical progress are complicated and many-sided. Therefore it is quite natural that they were at the center of attention of the Economic Summit Conference of the CEMA Member Countries. On the basis of the in-depth scientific analysis of the changed external and internal conditions, trends and laws of the development of the modern scientific and technical revolution the conference elaborated a new long-range strategy of cooperation, which satisfies the requirements of the changeover of the national economy of the

CEMA member countries to the intensive means of development, the assurance of the further dynamic growth and the increase of the efficiency of social production.

For the implementation of this strategy the conference participants came to an agreement about the joint formulation on the basis of national programs of the Comprehensive Program of the Scientific and Technical Progress of the CEMA Member Countries for 15-20 Years. It should serve as the basis for the elaboration of a coordinated and, in several areas, a unified scientific and technical policy and should specify the means of the quickest solution by joint efforts of the most important problems of science and technology and the introduction of the achieved results in production in the interested countries on mutually advantageous terms.

Taking into account the wide range of directions of the development of the current scientific and technical revolution, the CEMA member countries consider it fundamentally important to concentrate material, financial and manpower resources on the solution of those key problems which play a decisive role in the assurance of the basic increase of labor productivity on the basis of the changeover to highly productive and economical generations of machines and qualitatively new technologies. The participants in the economic conference decided unanimously that the introduction of electronics, complete automation, including flexible automated manufacturing systems, atomic energy, the development of new types of materials and technologies and biotechnology are such priority directions of cooperation in the sphere of scientific and technical progress. The most important goal of the formulation of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries consists precisely in ensuring the concentration of the efforts of the fraternal countries on these decisive directions of cooperation.

Thus, the Comprehensive Program of Scientific and Technical Progress may become the guiding unit of the further development of the integration process within CEMA. For this it is necessary, first, that favorable conditions for the complete use of the possibilities of scientific and technical progress and the international socialist division of labor would be created in the national economic mechanisms. Second, it is necessary to find and use new forms of integration cooperation, which ensure the orientation of cooperation toward the end results and the coverage by other cooperative relations of all the stages of the science--technology--production--distribution--consumption cycle.

The improvement of the economic mechanisms of the CEMA member countries is of basic importance for the rapid development of the processes of the intensification of social production on both the national and the international scale. Therefore, the collective experience in this area is becoming with each year a more and more significant factor of the economic development of each of the fraternal countries.

In this connection the problem examination of the present stage of the improvement of the economic mechanisms in the countries of the socialist community as applied to the tasks of the acceleration of scientific and technical progress seems urgent. Having started in the European CEMA member

countries at the turn between the 1970's and 1980's, it was aimed at the more complete utilization of the qualitative factors of economic growth, the mastering of the latest achievements of the scientific and technical revolution and the further increase of the labor and social activeness of the masses. It is characteristic that the attention during this period was focused on the overall improvement of the entire economic mechanism and on the coordinated reorganization and the strengthening of the mutual complementariness of all its units. Owing to this the area of the search for means of the systematic resolution of the objective contradiction between science and production and for new reserves of its intensification on the basis of the introduction of scientific and technical achievements was broadened substantially.

The main guiding line of the stage of work in question is to aim the economic mechanism as a whole at the end results and the increase of production efficiency. Only in this direction is it possible to create a socioeconomic atmosphere of interest in the maximum utilization of all the factors of the increase of efficiency, among which the leading role objectively belongs to scientific and technical progress. Only in this direction is it possible to realize most completely the potentials of the international socialist division of labor in the matter of the intensification of the national economies and their large-scale reorganization on a modern technical basis.

Of course, a specific approach to the solution of the problems of improving the economic mechanism is characteristic of each of the fraternal countries, which is connected with the peculiarity of the conditions and factors of the present stage of the development of the individual countries, as well as with the exploratory nature of the changes occurring in the forms and methods of management. At the same time the analysis of experiments and practically implemented steps makes it possible to distinguish a number of main directions of the improvement of management, which are common to one degree or another to all the European CEMA member countries.

First, this is the increase of the comprehensiveness of the centralized planning of economic and social development and the real transformation of the five-year plan into the main form of planning and into the basis of the organization of all economic activity. Particular attention is being devoted to the plan of scientific and technical progress becoming the core of the national economic plan.

Second, the coordinated reform of the organizational structures of the scientific research base, production and management with an orientation toward the strengthening of the contact of science with production; the search for more efficient forms of the organization of all the stages of the science--technology--production cycle, which ensure the rapid and large-scale introduction of the achievements of scientific and technical progress. The broadening of the sphere of measures on scientific and technical progress, which are based on flexible contractual forms of the cooperation and coordination of the activity of organizations of different types and different departmental subordination, is also assigned to this direction.

And finally, third, this is the further development of the system of economic levers and stimuli (cost accounting, financing, pricing, stimulation) for the increase of the interest of economic organizations in the improvement of the end results of their activity, the broadening of their rights and opportunities in the increase of the technical level of production and the quality of the output being produced and the more complete coordination of the interests of all the participants in the cycle of the development, introduction and use of new equipment.

The corresponding economic measures, the experience of their introduction in management practice and the real gains connected with them have been covered extensively in the press of the fraternal countries. Along with this there are a number of difficult problems of the improvement of the economic mechanisms, the solution of which presumes protracted and stage-by-stage implementation, where for the present it is still difficult to identify the completed and unambiguous results. However, it seems that the comprehension of precisely these problems, the study of the approaches to their solution, which are used in the countries, and the evaluation of the available experience are especially necessary for successful progress in the direction of the improvement of economic practice in all the CEMA member countries.

The Integration of Planning

The problem of scientific, technical, investment and production planning is one of the most complicated ones in the way of the increase of the comprehensiveness of its social and economic development. In essence, it consists in shifting from a narrow understanding of scientific and technical progress as the primary assimilation of the results of scientific research and development to a broad understanding, which envisages the reflection in the plan of the complete cycle of the development, assimilation, mass introduction and use of new equipment, as well as assignments on the removal from production of obsolete equipment. Here it is important to develop more advanced methods of evaluating the end results of the use of new equipment and their influence on the change of the rate of development and the structure of the national economy and of taking this influence into account in the plans. The drafting of an independent section of the national economic plan, as is now done, is insufficient. It is necessary for the tasks of scientific and technical progress to be the basis for the entire national economic plan and to permeate all its sections and for the indicators of the introduction of technical innovations to be closely linked with the basic indicators of the rate and proportions of economic development.

Goal program planning is one of the methods being used in the fraternal countries for solving this problem. The point is that an extensive set of diverse measures, which at times are poorly linked both with each other and with the ultimate goals of the solution of scientific and technical problems, is traditionally encompassed by the plan of scientific and technical progress. As a result the management of scientific and technical progress is dispersed among individual types of measures, functional spheres and the stages of the development and assimilation of new equipment. Under these conditions the goal program approach is also regarded as an important means of ensuring the systematic nature of the measures being planned, of increasing their goal

orientation toward the end results and of concentrating forces and resources on the solution of priority problems.

The analysis of the collective experience shows that the goal program method is gradually becoming the dominant form of the centralized planning of scientific and technical progress in the majority of countries of the socialist community. Today state scientific and technical programs serve as the basic tool of the implementation of the unified scientific and technical policy in Bulgaria, Hungary, the GDR, Romania, the USSR and the CSSR. The assignments on their implementation are included first of all in the state five-year plans of the development of science and technology.

During the current five-year plan from 16 to 30 percent of all the resources channeled into the development of science and technology have been allocated for the fulfillment of these programs in the European CEMA member countries, while the anticipated economic impact from their implementation at the end of 1985 will come, according to preliminary estimates, to 25-60 percent of the impact of all the measures included in the state five-year plans on science and technology. Thus, in the Soviet Union in 1981-1985 it is planned to allocate about 39 billion rubles for the implementation of 170 all-union scientific and technical programs, including about 11.5 billion rubles for scientific research and experimental design work and about 27.5 billion rubles for capital investments. According to expert estimates, the economic impact from the introduction in 1985 of the new equipment being developed in accordance with the programs will come to about 25 billion rubles, which is comparable to the impact from all the scientific and technical measures introduced during the five-year plan. The fulfillment of the programs will make it possible to save about 4 million tons of ferrous metals, 50 million tons of standard fuel and 15 billion kWh of electric power and to free for other jobs about 3 million people.

Considerable positive experience in the management of state scientific and technical programs, which is of mutual interest, has been gained in the CEMA member countries. For example, in the GDR the state orders on science and technology, which are included in the five-year and annual national economic plans, serve as an analogue of such programs. The Ministry of Science and Technology jointly with the State Planning Commission supervises their elaboration. The corresponding assignments for scientific research and experimental design work, as well as the measures on their material and technical supply are planned centrally.

The supervision of the fulfillment of the assignments, which follow from the state orders on science and technology, is assigned to the ministers, the executives of other state departments, the president of the Academy of Sciences and the general directors of combines, while the monitoring of the fulfillment of these assignments is carried out centrally under the supervision of the Ministry of Science and Technology jointly with the State Planning Commission. The fact that the fulfillment of the majority of assignments is assigned by the state five-year plan to combines which have the necessary scientific and production potential for the development, assimilation and launching of the production of the corresponding types of new equipment, is also an important feature.

In Hungary the stimulation of the economic interest of economic organizations in participating in the fulfillment of scientific and technical programs is the basis for the mechanism of their management.

The policy of formulating and using the set of scientific and technical programs as the main means of the formation and implementation of the long-term strategy of the development of scientific and technical progress and of turning the programs into the core of the five-year plan is characteristic of other countries. For example, in the Soviet Union a set of programs, which includes all-union, republic (interrepublic) and sectorial (intersectorial) scientific and technical programs, as well as the programs of regions and territorial production complexes, will be formulated starting with the 11th Five-Year Plan. In the CSSR the transition to the planning of scientific and technical progress on the basis of a set of long-term comprehensive and state goal programs and state scientific and technical projects has been planned and is being carried out.

The significant gains, which have been made by the fraternal countries in the use of the goal program planning and management of scientific and technical progress, should not overshadow the unsolved problems and untapped reserves. The methodology, criteria and methods of the choice of program problems and the questions of the technological coordination of the formulation of the programs with the entire system of planning calculations have still been inadequately studied. The methods of forming the programs as a fundamental part of the five-year national economic plan require further improvement.

Significant reserves of the increase of the efficiency of the use of programs are connected with the changeover to more efficient organizational structures of program management, with the development of the special-purpose financing and material and technical supply of the programs and with the use of problem-oriented information systems for their management. It seems that the exchange of experience and the combining of efforts in the solution of these and other problems are assuming particular urgency in connection with the development of the work on the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries.

In examining the problem of the integration of the planning of science and technology, capital construction and production, I would also like to bear in mind a number of problems, the solution of which for the present is still complicated by the inadequate soundness of the recommendations of economic science. Among them, in particular, are the optimum combination of the current and long-range tasks in the plans of scientific and technical progress and the national economic plans, the coordination of the planning of science and technology and the processes of the division and concentration of labor in social production (specialization, concentration, cooperation and combination) and the changeover to the planning of scientific and technical progress and production on the basis of the consideration of the cycles of the updating of products and the active portion of the fixed production capital.

The Development of the Organizational Forms of the Integration of Science and Production

Today the introduction of technical innovations in production is one of the greatest bottlenecks in the system of the management of scientific and technical progress. As is known, the scientific and technical cycle consists of two basic phases: the preparation of scientific and technical knowledge for use in production and its immediate application for the increase of the scientific and technical level of production and the output of new products. The potential impact of scientific and technical progress is formed within the first phase, in the second phase it receives production realization.

The basic problem is that a significant portion of the obtained potential impact at present is not being realized in production. For example, according to the estimates of economists, in the USSR only about one-third of all discoveries and inventions are introduced. The results of research and development are used in the overwhelming majority of cases at one or two and only in rare cases at five and more enterprises.

The reason for such a phenomenon consists in the existence of a large number of organizational and economic difficulties which arise for enterprises in case of the introduction of new equipment. First of all they are of an economic nature and are connected with the fact that the ratio of the value of the expenditures on developments and on their assimilation comes on the average to 1:10. A serious economic barrier thereby emerges: it is not enough to develop some innovation, it is also necessary to have considerable assets for its introduction.

Moreover, not all enterprises have their own scientific and technical base which is sufficient for the production "development" of technical innovations. There are also organizational difficulties, which are connected with a certain isolation of the efforts on the development and mass use of already approved innovations. All this served as the reason for the development in the CEMA member countries of the most diverse organizational forms of the integration of science and production and the stepping up of the introduction of technical innovations.

The development of such forms is being carried out first of all by the concentration of scientific, technical and production activity in large scientific production complexes (especially in machine building and instrument making), of which two basic means are characteristic:

--the integration of the sectorial scientific and technical potential and production potential (these are first of all combines in the GDR, many production associations in the USSR, subsectorial production economic associations in the CSSR and so forth);

--the integration of the activity of scientific research and experimental design organizations, experimental and pilot plants (scientific production associations in Bulgaria and the USSR, research and production units in the CSSR and so forth).

The experience of the CEMA member countries shows that the first means creates favorable organizational and economic conditions first of all for the constant technical updating of major works and the increase of the qualitative level of the output being produced. The industrial combines of the GDR, in which the entire reproduction chain from scientific research and experimental design development to the series output of products and their sale on domestic and foreign markets is united, are the most vivid example. More than 70,000 specialists are employed at the combines. The outlays on the production of means of rationalization now come to about 20 percent of all the industrial capital investments in the output of machines and equipment.

Such integration made it possible, as practical experience shows, to overcome the disunity and departmentalism in scientific research and to use the results of development more efficiently in production. At present about 20 percent of the products of the leading combines are updating annually, 70-80 percent are awarded the Emblem of Quality. It was possible to shorten significantly the time of the work on the research-introduction cycle and to provide a significant saving of resources.

At the subsectorial production economic associations in the CSSR, which include the units for research and development, the unified management of all the units of the scientific and technical cycle, in which more than 65 percent of all the workers engaged in scientific research and experimental design work are concentrated, is now also being carried out.

More than 4,000 production associations are already operating in USSR industry. Their basic task is the production and economic assimilation of new equipment and the output of high quality mass-produced products. Many of the established associations have their own scientific and technical subdivisions, which perform applied research and development, more than 300 scientific research institutes and design bureaus belong to them. The experience of the work of large production associations in the automotive industry and in a number of sectors of machine building attests to the promise of this form of the integration of science and production.

At the same time the establishment of associations is the beginning of the economic reorganization of the structure of USSR industry. For the present many associations, although having achieved a specific level of efficiency, still are far from the optimum model--the large production economic complex, which conforms to the present level of the concentration and centralization of production. At times what is called an association is a large enterprise with several medium-sized and small enterprises which belong to the same ministry. Therefore, the urgency of solving the problem of establishing flexible, optimally large scientific production complexes, which have developed scientific, technical and planning services, a pilot works, plants for the series and mass production of new equipment and subdivisions for the complete service of its users, at present still remains. The establishment of production associations, which are founded on an extradepartmental, primarily sectorial, and, in specific cases, an interdepartmental basis, is promising.

In most concentrated form the organizational integration of scientific, technical and production activity receives embodiment in the second form--in

scientific production associations. The devising and complete development of models of new equipment and their transfer to enterprises and associations for mass production are their basic task. In the USSR about 250 scientific production associations are now in operation. The activity of such scientific production associations as the Kriogenmash in Moscow, the Pozitron in Leningrad, the Plastpolimer in Okhta and others attests to the great effectiveness of this organizational form. In 1984 for the improvement of the work the scientific production associations of a number of ministries as an experiment were converted to the planning of their activity as a whole according to the section "science and scientific service" with the exclusion from the list of indicators, which are approved by the superior organ, of the assignments on the total volume of output. Thereby the planning and evaluation of their activity will be more closely linked with their basic function--the development of new equipment and the organization of the series production of new products at enterprises and associations of the sector.

It is necessary to emphasize that along with the rapid development of scientific production associations the problem of the formation of a new type of associations (scientific production complexes), which ensure not only the development and the production of test batches of fundamentally new equipment, but also its bringing up on their own to the complete satisfaction of users, is becoming urgent today. Apparently, for this it would be possible to transfer to the corresponding scientific production associations (with allowance made for economic expedience) the leading scientific and technical enterprises of the sector. This would increase the role of such complexes in the scientific and technical development of sectors and would make it possible to concentrate their activity on the development and commercial production of fundamentally new types of equipment.

The increase of attention to large production economic units in a number of CEMA member countries for the present does not rule out a certain increase of the number of medium-sized and small industrial enterprises. Practical experience shows that the majority of such enterprises, as a rule, are still of a small-series nature and have a finished-items specialization of production. Often they have general-purpose equipment and a complete set of basic and ancillary shops. They have a labor productivity, which is several fold less, and a higher product cost than at large enterprises. It is natural that such enterprises are not conducive to the increase of production efficiency.

The experience gained in the fraternal countries is enabling small enterprises to find an appropriate place in the industrial structure. Drawn into the orbit of large production complexes, converted into their narrowly specialized affiliates and furnished with highly productive equipment, they could concentrate a significant portion of the production of one specialized item or another. The implementation of such approach to the concentration of production (not concentration in general, but the concentration of specialized production), in our opinion, would substantially increase labor productivity and product quality.

Here the fact that small and medium-sized enterprises are capable of reacting more rapidly and flexibly to the changing conditions of work and the demands

of the market, is also of not small importance. Experience shows that these enterprises agree more willingly to the introduction of technical innovations, are less afraid of the risk connected with this and so forth.

At the same time these enterprises have a large number of problems of technical development, which are connected with their limited potentials and resources. Their overcoming in the CEMA member countries is being accomplished by:

--the establishment of cost accounting introducing organizations (in addition to serving small and medium-sized enterprises they are aimed in the countries at the solution of intersectorial problems, as well as problems involving an increased economic risk), which give enterprises scientific, technical and financial support in case of the introduction of technical innovations (Bulgaria, Hungary, Poland);

--the development of flexible, constantly evolving forms of the contractual coordination and cooperation of scientific, technical and production activity (cooperation on the output of groups of items in the GDR, gestsii [translation unknown] in the CSSR and others), the establishment of voluntary associations for the joint management of economic activity, including with the right of a legal entity (the Bulgarian Industrial Economic Association, the Engineering Society for Coordination and Cooperation in the Area of the Introduction of Scientific and Technical Achievements in Bulgaria, joint contractual enterprises and associations for the coordination of economic activity in Hungary).

The development of various forms of cooperative ties among the participants in the scientific and technical cycle reflects the formation and enrichment of the new type of economic relations among them. This process involves the increase of the economic independence and responsibility of enterprises, the overcoming of departmental barriers (which are characteristic of the sectorial principle of the management of industry) and the intensification of the division and combination of labor in science and technology. The cooperative forms of the integration of science and production, which to a significant extent are of a voluntary nature, lend considerable flexibility to the organizational structure of the management of scientific and technical activity. However, today it would still be too early to say that the possibilities of this form are being fully utilized. This process is still just arising.

As a whole the experience of the CEMA member countries shows that the integration of the management of scientific and production complexes can and should be based not only on the implementation of organizational reforms and the development of new forms, but also on the use of various contractual scientific and technical and scientific production relations. Here first of all the conformity of the common goals, which are established by directive, to the mutual interests of the cooperators should be the basic principle, on the basis of which contractual relations can be organized. Apparently, the plan assignments, which can be both common ones for the partners to the contract and separate ones, which originate from a unified center of management, should be the basis for the corresponding relations. It seems that this form can be

used most effectively in intersectorial and regional scientific production cooperation.

The Stimulation of Scientific and Technical Development

The integration of science and production, which has been expanding in recent years, required the increase of the goal orientation of all the forms of economic influence on the utmost stimulation of the achievement of the end results of scientific and technical development. This, in particular, also found expression in the new demands on the financial interrelations of scientific and technical organizations with production. The main one of them is the gradual replacement of the principle of "the payment of expenses," which dominated in recent years, by the principle of "the payment for the results" of scientific and technical activity. The introduction of the latter transforms the financial system from one which distributes assets into one which actively participates in the management of research and development. The changeover to payment for the actual results is conducive, as the experience of a number of fraternal countries attests, to the strengthening of cost accounting interrelations and increases the material liability of the developer for the scientific and technical level, time and cost of the performance of operations and of the client for the rapid introduction of the results in production. Moreover, such a procedure prevents the inordinate increase of the amounts of unfinished production in science (until recently this increase frequently led the value of the completed and introduced work).

The problem of stimulating the development and production of fundamentally new equipment and technology, the output of which has not yet become economically profitable to the proper extent for all enterprises, is very important and for the present still inadequately solved in the CEMA member countries. The point is that this requires large one-time outlays, the fundamental reorganization of production and some economic risk, which worsens substantially the economic indicators at the initial stages of the assimilation of the production of fundamentally new equipment.

Under the prevailing conditions of management frequently the enterprises, which carry out the partial improvement of already assimilated equipment, which guarantees the achievement of higher (in the prevailing systems of evaluation) production indicators with comparatively small expenditures of material and material resources, find themselves in a more favorable position. The experience of the CEMA member countries testifies that additional economic stimuli and levers, which make the development and introduction of fundamentally new equipment more profitable, are needed for changing such a situation. Apparently, the consideration and differentiation in case of the evaluation of the results of scientific production activity of both the individual expenditures on the production of fundamentally new equipment and the individual impact from its use in the national economy could become a definite step in this direction.

When solving this problem much depends on the methods and forms of the evaluation of the activity of all the participants in the science--technology--production cycle. The specification of the evaluation indicators of the activity of each participant and their linking with the ultimate

national economic impact are one of the basic things here. When solving it in several CEMA member countries they are taking, in particular, the path of the use of contract prices for the results of scientific and technical development. Such a mechanism enables the client in case of the conclusion of a contract for research, planning and design and introduction work to estimate the potential ultimate impact, to determine the profit of the corresponding organizations in the form of its share and on the basis of these calculations to advance money for the work.

In the CEMA member countries some experience of forming contract prices in the innovation sphere has already been gained. For all its value it should be pointed out at the same time that many methodological and procedural principles in this area have not yet been completely worked out. In particular, this pertains to the calculation of the economic impact in case of the introduction of completed scientific developments, the distribution of this impact among all the participants in the innovation cycle and the determination of the intermediate impact for the establishment of the contract price.

In a number of CEMA member countries (the USSR, the CSSR and others) the determination of the upper and lower limits of the price is one of their methods of establishing the prices for new items. The upper limit guarantees the user the equal efficiency of the use of the new product and the product being replaced, the lower limit ensures its equal profitability for the producer. The difference between the upper and lower limits is divided between the producer and the user so as to ensure a relative decrease of prices as a result of technical progress, here a large portion of the difference is used for the stimulation of the user.

Practical experience, however, shows the existence of considerable difficulties in case of the implementation of these progressive principles. One of them consists in the fact that there are instances when the difference between the upper and lower limits is a negative quantity, in this case not the impact, but the loss has to be divided between the producer and the user of the new equipment. As a rule, this loss is a temporary phenomenon, all the same during the initial period of the production of new equipment economic difficulties arise in this connection both for its producers and for its users. To a considerable extent they are resolved by means of such flexible forms of pricing as the establishment of cost accounting subsidies and various markups and reductions on the wholesale prices, the introduction of graduated prices for items, with respect to which a decrease of the production cost is expected during the period of the increase of the production volumes, and others.

In speaking about the development of the national systems of the management of scientific and technical progress and identifying the common laws in this process, it is necessary at the same time to emphasize that each country has its own peculiarities. For the present the results of development have not yet affected everywhere in the optimum manner the acceleration of technical progress and the extensive introduction of its achievements and the increase of the competitive ability of the output being produced. There is still a certain lack of coordination in those components of the measures on the

improvement of scientific and technical progress, which directly influence scientific and technical cooperation and create an interest in it. Therefore, in all the CEMA member countries the search for the most effective forms and methods of the management of scientific and technical progress is continuing. This is a continuous and creative process.

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SOCIO-POLITICAL FACTORS

BURLATSKIY ON TECHNOLOGICAL REVOLUTION

Moscow LITERATURNAYA GAZETA in Russian 19 Jun 85 p 2

[Article by LITERATURNAYA GAZETA political observer Fedor Burlatskiy under the rubric "Toward the 27th CPSU Congress: Experience, Problems": "The Technological Revolution and the U.S."]

[Text] The article we publish here is an invitation to discuss the problems of accelerating scientific and technical progress. To discuss what we can and must do to fling wide the doors for the application of the achievements of the scientific and technical revolution in the national economy. This is one of the tasks set at the April (1985) CPSU Central Committee Plenum and in M. S. Gorbachev's report at the recent conference at the CPSU Central Committee on questions of speeding up scientific and technical progress.

There is no need to demonstrate how much our country has achieved in its industrial development. Our state's economic and military might, the resolution of the problems of social and national equality--all these gains won by the pioneers of the new, socialist civilization speak for themselves.

But we must think of the future. And the technological revolution spurs on such reflections. Either we get a grip on it and master it, or other peoples and states start to overtake us and crowd us out. This is damaging even in sports, as the recent world ice hockey championship showed. But it is quite impossible when it is a question of the country's might, its greatness and international influence. The new technology should enrich all spheres of our economy and become an integral part of our life.

Here the reader may well ask: But what does this mean specifically for me? What can I do? How can I become involved in this race for modern technology and technical progress? A reasonable question, and there is a reasonable answer to it.

As was stated at the conference at the CPSU Central Committee, the first thing each of us must do is largely to reshape our own consciousness. We have developed rapidly, swiftly, but not always, so to speak, harmoniously. That is probably why there has been some tendency for the mass psychology to lag

behind the technological developments taking place in our society, and indeed throughout the world. That is probably why the high level of education has not yet fully or in all respects been adequately reflected in the standard of labor and the way of life. Herein lies a vital source of accelerated progress, in which man himself is the motive force, with his professional culture, sense of responsibility, commitment, and patriotism.

Is Everyone Aware?...

Yes, that is the question: Is every one of us aware of the truly revolutionary nature of the new technological turnabout, which started in the 1970's and, like the ocean waves, is now spreading all over the world?

Competition--economic, military, cultural, informational--between different social systems is taking place in the toughest possible form and at a more rapid pace than ever before. In order to win this competition you have to advance rapidly, very rapidly (on the nature of the present technological revolution and its international consequences, see: "The Technological Revolution and Robot Ethics," LITERATURNAYA GAZETA, No 44, 1984).

The first industrial revolution, which began in the 18th century, took approximately 200 years to reach its culmination. The second scientific and technical revolution reached its heights in a mere 40 years or so. The present technological revolution is progressing at astronomical speeds. It is embodied in microcomputers, information science, new materials, previously unknown energy sources, new technology in all sectors of the economy, a new level of automation, the first and second "green" revolutions in agriculture. It will take less than 25 years for modern technology to totally transform the industrial base of the industrially developed countries. And our socialist country must be on the crest of the technological revolution. As M. S. Gorbachev has said, it is incumbent on us in a historically short space of time to reach the forefront in labor productivity, product quality, and production efficiency.

How does the new stage in the struggle for a leading place in world technology begin? First, it was stressed at the April CPSU Central Committee Plenum, it is necessary to change priorities among the sectors of the national economy, which means changing all technological and economic policy on a long-term basis.

Let us touch on a sacred cow: steel. For many decades we have been repeating that steel is the fundamental basis of our industry. In general this principle retains its significance to this day, but with very substantial amendments. First, it is not just any steel, but high quality steel which can be used for the production of high precision modern machines. Second, not only steel, but also plastics and other materials which can replace metals.

People may say: Before investing resources in new sectors, we must pull up the lagging or less developed sectors--agriculture, transportation, light industry, the service sphere. Industry's raw material supplies and communications and, therefore, the normal, uninterrupted operation of

enterprises depend on them. The people's living standard depends on them. That is true. All the same, new sectors of the national economy are coming to the fore. Here an analogy with the early period of industrialization in our country suggests itself to some extent. In the 1930's we seized on the sectors which were the leading sectors at that time--metallurgy, electrification, motor vehicle production, aircraft building. It is the same thing now--the sectors in the lead are those which symbolize technical progress.

We have so far been taking about large-scale problems. But what does the technological, computer revolution mean for each enterprise, kolkhoz, or scientific institution?

The following proposal could be put forth as a basis for discussion. Every enterprise--be it a truck plant, a poultry unit, or a computer laboratory--should start by drawing up a technological modernization program. Specifically a program, not just a plan. Why? Because a program leaves room for free thought; it is directed toward a desirable future. But a plan requires clear orientation toward available resources, and could be purely a working component of the program.

The authors of such a program could realistically--which means honestly and frankly--compare the standard of their own economic unit with the best examples, at home and abroad, taking the rapid development of technology into account. And then, if only in general terms, they could outline stages in the unit's modernization, the improvement of its efficiency, and the radical improvement of product quality. In other words, they could determine how to achieve the universal dissemination of the good examples already achieved in our country and of world standards in general in various spheres of science, technology, and production.

Qualitative Transformations

In general terms it is clear that the introduction of the achievements of the technological revolution will be possible if urgent changes are made to the structure of production relations, the planning machinery, the organizational and legal structure of enterprises, the nature of the relationship between production and distribution, the forms and methods of incentives to ensure the best indicators, the structure of consumption--in a word, all spheres of the national economy and social management. But there are no ready-made models for such transformations, they are suggested by the analysis of our own experience, the results of experiments, and practice in the other socialist countries and the whole industrial world.

Under the conditions of capitalism, the process of transformations takes place more or less spontaneously. Structural developments occur chiefly within the framework of each monopoly or enterprise, in the system of training of working people, and so forth. True, government policy is increasingly frequently taking on the role of regulator of this process. In Japan, for instance, the state has long been stimulating the most modern sectors of industry, as well as changes in the education system.

In our conditions, any qualitative changes in production, distribution, or education can only be the result of planned activity. But this means that the problem of the interpretation of the complex processes of elaboration of development concepts and their embodiment in decisions and plans becomes particularly acute. Attention was drawn to this too at the conference at the CPSU Central Committee on questions of accelerating scientific and technical progress.

The most complex problem is to decide not what must be done, but how, by what means. The party answers this question as follows: It is necessary to achieve a qualitative change in the condition of society--its economy, the system of sociopolitical relations and institutions, and the whole of the labor and life of millions of Soviet people.

In this connection mention must be made of certain prejudices which hamper the elaboration of the concepts of accelerated development. Chief among these prejudices--and this is no mere abstract trick of the mind--is the failure to understand the dialectical nature of socialist development, fear of any contradictions, and the inability to take advantage of them in the interests of development.

There is a view that contradictions are always a bad thing, that a contradiction must be resolved and reduced to some kind of noncontradictory essence. But it is profoundly misleading to think that way. Contradiction is life itself, a source of development. Of course, it is harmful and dangerous for society if a contradiction reaches the level of antagonism or crisis. But such contradictions are not characteristic of socialism. The contradictions which are characteristic of it therefore become natural stimuli to growth, given the correct attitude to them.

That seems paradoxical, does it not? The commonplace stereotype looks basically like this: All civilizations have hitherto developed on the basis of struggle and contradictions, but our civilization will develop without contradictions or struggle.

This nondialectical way of thinking has not simply penetrated the consciousness of individual theorists and propagandists. No. It has been reflected in practice too, and has acted as a brake on competitiveness and social activeness.

Competition, Rivalry

We have rejected the merciless competition [konkurentsiya] and private initiative whereby capitalism develops. These things are alien to socialism's very nature. But does this mean that we have rejected competitiveness [sostyazatelnost], personal initiative, enterprise, inventiveness? Of course not. There can be no progress without the mechanism of competition. And it is by no means a question of a pleasant kind of competition where nobody loses.

Every person--on the kolkhoz, at the plant, in the scientific institution--must always feel that someone is in competition with him, someone is trying to

outstrip him. And when they do outstrip him, first of all it will be a moral victory for his rival, and then a success bringing that rival real advantages--in terms of prestige, material advantages, and others. The same principle applies to the activity of labor collectives.

Do we not give too little room to true socialist competition as Lenin conceived it? Are we not still putting the departmental principle in the place of competitiveness?

But no single department can foresee all the avenues of technical progress and incorporate them in the plan. On the contrary, what is needed is initiative on the part of every collective, every leader, every person at his place of work, augmented by their right to resolve particular problems autonomously. It might be worth thinking about dividing associations which are basically monopolies (for instance, those which produce consumer goods) into a number of autonomous units competing among themselves and receiving their dividends according to product sales.

In other words, competitiveness, collective and individual, is an essential component of production. The problem is to place the producer himself in conditions which stimulate enterprising, highly productive labor on his part and encourage the desire constantly to introduce the achievements of science and technology into production.

Of course, all this is easier to say than to do. But that is why we carry out socioeconomic experiments. That is why we test new forms of labor organization. Like the brigade contract at enterprises, the link method on kolkhozes, and other forms of relations based on true financial autonomy.

Professionalism and Labor Organization

Are we fully aware that our society's further progress--technological and social--depends on each of us? On the level of qualifications and activeness of each working person, from the worker, peasant, teacher, or doctor to the minister? The most up-to-date level of highly skilled labor is vitally necessary to all of us.

The problem of eliminating unskilled labor, which still has an important place in overall labor activity, is well known. But the problem of labor using top skills (by "top" we mean the best models at home and worldwide) is equally acute. I suppose this is the key which will enable us to solve two problems at once: to make the leap forward toward tomorrow's leading technology, and to resolve more successfully the problem of unskilled labor.

What is the place of highly skilled labor in the overall labor balance of our country today? Is it 10 percent, 15, 5? The figures are not available. But it is clear even to the naked eye that as yet the percentage is small. Moreover--and this is the worst aspect--there is a marked tendency for this kind of labor to descend toward the average, to sink to the level of merely skilled labor.

Should the worker be rewarded only on the basis of his status, or on the basis of the results of his labor too? Should all thermal engineers or doctors of science receive the same wage? In principle, that seems reasonable. And--most important--it is convenient for the purposes of accounting and financial control. But alas, it is not entirely fair, and--most significantly--it does not provide enough incentive for high quality labor. Because one engineer is not equal to another. One physician is not equal to another, one doctor of science to another, one writer to another, or one stage director to another. Some work with great commitment, skill, and enthusiasm, while others remain, so to speak, at the average level of skill.

What should be done? Wages should be based on the results of labor. Obviously, the struggle for efficiency and intensification of labor inevitably entails differentiation in remuneration. Whoever produces more output of better quality, earns more. Whoever is concerned to introduce new scientific and technological achievements, especially if he himself plays the part of inventor, merits a greater moral and material reward. The level of differentiation in labor remuneration is determined by the demands of production efficiency and social justice. Otherwise there is a tendency toward leveling and a fall in quality.

Now that technology is changing working conditions so rapidly, every person, wherever he works, should think: Is my labor up to the best standards at home and worldwide? Am I not lagging behind? This, without exaggeration, is the key question in the self-improvement of every Soviet person. And that means it is the key question in improving socialism.

Down with semiprofessionalism, indifference, and stagnation; long live skill and talent, impassioned, bold, innovative thought! That demand emanates from the innermost depths of the technological revolution.

Of course, it is not only the question of each worker's moral imperative which arises here. The most important thing is labor organization and the incentive system. It is one thing for average encouragement to be given to labor which is merely skilled, and quite another for the most highly skilled, talented labor to be singled out.

One urgent task put forward by the party is to improve the entire education system, especially the content of educational material, in the light of present and future achievements of science, technology, and engineering. This applies to schools, higher educational institutions, and the retraining of cadres in various spheres of economic, social, and cultural life.

The school reform which is now under way will undoubtedly focus attention on the problems of the new technological revolution, which today's school children will witness and participate in. Of course, today we need school graduates who will be able to enter into the production process immediately--on the kolkhoz and at the plant. But those who are studying today, especially those who are now in the primary grades, will be the creators of the future. And they must be prepared. They will embark on productive life at a time when the majority of the mass professions which now exist will be disappearing, with new ones growing up in their place. To prepare school children for

today's professions without taking account of the rapid development of science and technology and the automation and mechanization of production is tantamount to training a soldier for the last war rather than the next, as they used to say in the old days.

It would be extremely useful if our leading scientists in the sphere of the natural and technical sciences were to express their opinions on ways of modernizing the education system, preparing teaching aids, using microcomputers and other information science systems, and studying advanced technology. For my part, I would like to draw attention to the role which the social sciences could assume here. There is no need to say how much we expect of these sciences. Now more than ever before, what is needed is a profound knowledge of the society we live in and its real interests and problems and the elaboration of models of economic and social management which pave the way for scientific and technical progress. This was spokes of at the 26th CPSU Congress and at subsequent plenums of the CPSU Central Committee.

What does the successful resolution of the tasks set require?

First and most important--the strengthening of the social sciences' link with "social production," that is, first of all with the system of teaching, educating, training, and retraining cadres, the activity of the mass media, and thereafter, of course, with the entire system of social management and the organization of society's life. But this means developing the most humanitarian form of knowledge and overcoming conservative traditions which hamper the emergence of progressive scientific avenues which are particularly closely linked with practice. For instance, there is the theory of organization and management, concrete economics, concrete sociology, political science, social psychology and the study of public opinion, the science of man. These new or relatively new scientific avenues require particular support from the public, but unfortunately they by now means always receive it.

Here much depends on improving the organization of scientific labor. For instance, it has been calculated that leading specialists spend from one-third to one-half of their working time at meetings. And 20 or even 30 members of a scientific council spend hundreds of hours hearing dissertations. Yet only a few members of the council--the specialists in the subject--take part in the discussion. But technological progress requires accurate, expert assessments by professionals: based on skill, not numbers.

Another problem is the orientation toward collective forms of labor to the detriment of individual forms. Of course, both are needed, but all the experience of the development of the social sciences shows that they were and are a sphere of individual creativity. Also, of course, the system of incentives for scientific labor is extremely important, and must be adjusted so that social usefulness comes first and science is directed more and more decisively toward society's needs, as was stressed at the conference at the Central Committee.

We have long since ousted the idea that the management sphere can get by without professionalism. The party now makes particularly great demands on

cadres in the management sphere, as regards their political, practical, and moral qualities. Everyone realizes that in order to manage a kolkhoz well, you have to know agronomy, and in order to manage a plant, you have to know engineering. But there is another problem here.

Specialized knowledge in the sphere of organization and management is needed. This is an autonomous field which also requires certain abilities and professionalism. And you have to be not simply an average specialist, but a good one, or, still better, an excellent, talented one in order to manage a particular sector of economic or cultural life. Experience has already revealed sufficiently that a specialist of average abilities will inevitably delay the modernization process within the framework of the institution he heads. Only an outstanding specialist who is at the same time a good organizer and is boundlessly devoted to the cause of improving socialism is capable of working at a level which is up to the demands of scientific, technical, and cultural progress.

These may seem like truisms. But most truths are axiomatic. The trick is to follow them in our life.

Order and Civilized Behavior

Are we fully aware that each of us must think seriously about his own attitude to order and organization, his attitude to his own duties, his own daily behavior? Do your duty honorably, keep your word, do not lie, do not steal, do not drink, do not break the rules of civilized behavior--these very simple moral norms are an important condition of our social and technological progress. And it is time to give moral concepts their original meaning back. To "take" (at work, from a consumer) means to steal, to "give" (to those who distribute valuables, whether material or in terms of prestige) means a bribe, to "write up" (for your own sake or your collective's) means to deceive the state, to "get hold of" (goods in short supply) means to encroach on other people's rights, to "get away" (from work) means to go absent, to "make a formal reply" (to a complaint) means to display a bureaucratic approach. And "service" means serving people. It has nothing to do with making money on the side, deceiving people, or behaving loutishly.

Socialist civilization is the key to many problems of education and self-education.

An example which is clear to everyone is order in the streets, and this includes our beloved capital. Look at what is happening here! All three components of road traffic--pedestrians, drivers, and state traffic inspectorate controllers--are not properly prepared for modern conditions. Pedestrians ignore the pedestrian subways and traffic lights. Drivers try to push each other out of the way as if they were waiting in line for scarce goods. And the controllers? They are resisting the automation of traffic signals, although its indisputable advantages have long since been demonstrated.

An elementary norm of civilized existence is: If you are working, then work! You might think that goes without saying. The whole point of work is not just

to sit, stand, or walk, but to do something, produce something. But you will agree that it does not always happen like that. Some people manage to go for hours without really doing anything. Construction workers sit and have a smoke or even a "little drink." Secretaries sit reading detective novels hidden in the half-open desk drawer. Learned men, on the days when they visit the institute, sit--enriching themselves intellectually, of course: They play chess or solve crosswords.

What is the reason for this? Where does the mentality of idleness come from? Why do some people find it more pleasant not to work than to work? You would think it was excruciating to drag out your time with nothing to do. The reason lines in a poor inner culture. It has its roots in the distant times of forced labor (and avoiding it). But in our day this mentality is an absurd survival of the past.

And the problem of work that does not run smoothly? It may seem to be stretching a point, but by its nature this is a throwback to the patriarchal attitude, crystallized in the "Get on with it!" and "Yo heave ho!" forms of labor organization. This worked well enough when the barge haulers were pulling their loads on the river or on dry land. But in the age of microcomputers? Can you "heave ho" in space or when landing an airliner? The idea is laughable. So how is it that people can barely stir themselves in the first week of the month, and then do nearly half of the plan in the last week? Why should this be so, if not because of our atavistic mentality which takes the form of poor organization and lack of order?

Of course, much also depends on how people's capacity for work is restored, or to put in another way, on the nature of consumption and leisure. Can a person work properly if he is spending more on vodka than on food? The creation of a more up-to-date structure of consumption, public catering, and leisure is an essential condition for the molding of the modern type of working person.

Still on the question of the level of civilization, there is something which, for some unknown reason, we often count among the formal, external, and therefore insubstantial manifestations of culture--politeness and good will in human relations in all spheres of production and services. What lies behind this is not only "personal culture." No, what lies behind this is the rational organization of labor and a sense of responsibility on the part of every working person. Politeness, restraint, mutual understanding at work, at recreational centers, and at home--this is not a luxury, it is a condition of good creative labor.

Exchange of Experience

Are we fully aware of the need to master not only the skill of teaching others, but that of studying their experience?

As the pioneers of the new, socialist civilization, we have become accustomed to setting an example for other peoples. And our example is now used by practically one-third of all people in the world. This gives us a natural sense of pride. But pride has nothing in common with conceit. It would be

absurd to think we have nothing to learn from other peoples, especially in the sphere of science, technology, engineering, and methods of labor organization.

There is much that is new and interesting in the experience of the socialist community countries. The forms of labor organization in industry, incentives in agricultural production, and achievements and problems in economic reforms in Czechoslovakia, the GDR, Hungary, Bulgaria, and the other socialist countries are now common property, just as Soviet experience is. Of course, it is not a question of mechanically borrowing from each other. The conditions in each country are largely unique. It is a question of choosing your own most effective ways of resolving problems, taking full account of similar experience in the other socialist countries.

Each people has its own achievements in the worldwide technological contest. And the ability to learn from the best examples is a true sign of civilization. Japan shows us what successes can be achieved in this way. The initial impetus behind its technological takeoff was a unique ability to creatively master the achievements of peoples who had gone ahead.

We reject capitalism as a system of relations and values which is opposite to ours. But it is quite erroneous to attribute the achievements of science, technology, and culture in those countries to the capitalist system itself. Approximately 80-90 percent of the wage-earning population there are people who hire out their labor: workers, engineers, scientists. And we really have more in common with them than they do with their bosses. Is there any harm in exchanging with them (even through their bosses!) the best achievements in the sphere of scientific and technological creativity?

How could any one country, even the most highly developed industrial country, be capable of outstripping all other countries in the sphere of scientific and technical progress? This is not possible either for Japan, or for the United States, or for the Soviet Union.

We cannot come first in all kinds of sports. We realized that long ago, just as we realized that all the same, we must strive to do so. In just the same way, we cannot come first in all spheres of modern technology. That would mean all other peoples marking time--without talent or skill. But we must strive to be at the highest level in all spheres of labor activity. In space, electronics, information science, motor vehicle building, genetic engineering, medicine. We must not be satisfied with the highest achievements in some spheres and tolerate laggardness in others. On the contrary, the entire social organism should be aware that its efforts, its will for self-development are bound up together.

Only when the desire for the highest knowledge and labor productivity and a true passion for creativity and self-improvement grip millions of people will we really be able to unite socialism's advantages with the achievements of the scientific and technical revolution.

CSO: 1814/204-F

AWARDS AND PRIZES

PRIZE NOMINATION FOR PHOTOELECTRON SPECTROSCOPY METHODS ENDORSED

Moscow PRAVDA in Russian No 237 (24494), 25 Aug 85 p 2

[Article by Zhavoronkov, N., academician; Paton, B., academician]

[Excerpt] The scientific-technical revolution has created higher demands on materials that are used in machine building, the chemical industry, microelectronics and other fields. Investigation of the electron structure of matter and of the surface of solids therefore takes on special importance.

In recent years, photoelectron spectroscopy, which is based on phenomena of the outer photoemissive-effect, has become one of the main methods of this type and the most effective one. A substantial contribution to the development of such methods and their application in science and technology has been made by Soviet scientists, and foremost by the authors of a cycle of works that has been nominated for the 1985 USSR State Prize. They represent a number of the country's scientific institutes.

Photoelectron spectroscopy with ultraviolet excitation for gases and vapors was first proposed by Professor F. Vilesov as a method for investigating the electron structure of chemical compounds. This major achievement of Soviet science was registered as a scientific discovery. In the process of advancing this method, F. Vilesov and a group of associates developed a number of excellent photoelectron spectrometers.

With the aid of X-ray photoelectron spectorscopy, one can determine the presence of elements if the amount of them in a substance is one ten-thousandth of a gram, and one needs only one ten-millionth or even one-billionth of a gram of an element in order to detect it.

The method has been used with particular success in studying the surfaces of lunar regolith particles. Soviet scientists established a relationship between the surface composition and the exposition age of regolith, which was registered as a discovery together with the detection of reduced forms of elements in the surface layers of regolith.

Thanks to its high sensitivity, the method of photoelectron spectroscopy is broadly used in controlling and forecasting various physical-chemical properties of surfaces. This is particularly important in solving problems connected with corrosion and catalysis, and with the development of new materials for computer technology.

FTD/SNAP
CSO: 1814/279

AWARDS AND PRIZES

I.R. YUKHNOVSKIY AWARD

Kiev PRAVDA UKRAINY in Russian No 201 (13171), 7 Sep 85 p 7

[Text] By decree of the Presidium of the USSR Supreme Soviet, the order of the Red Banner of Labor has been awarded to Igor' Rafailovich Yukhnovskiy, member of the Ukrainian Academy of Sciences, for his service in the advancement of physical science and the training of scientific personnel, and in connection with his 60th birthday.

FTD/SNAP
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BIOGRAPHICAL INFORMATION

YU.V. D'YACHENKO, (OBITUARY)

Moscow MOSKOVSKAYA PRAVDA in Russian No 186 (19906), 14 Aug 85 p 4

[Text] Lenin Prize laureate Yuriy Vasil'yevich D'Yachenko, a member of the Communist Party of the Soviet Union, had died.

The announcement of the untimely death is made with deep regret by the Kiyevskiy Rayon Committee of the Communist Party, and by the administration and party and trade-union organizations of a design bureau, and profound condolences are expressed to the family and friends of the deceased.

FTD/SNAP
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BRIEFS

ACADEMICIAN DECORATED--The USSR Supreme Soviet Presidium has awarded corresponding member of the USSR Academy of Sciences Mikhail Grigoriyevich Meshcheryakov, director of Computing and Automazation Laboratory of the Joint Institute for Nuclear Research, Order of Friendship of Peoples. [Text] [Moscow Domestic Service in Russian 1100 GMT 16 May 85 LD] /9716

OBITUARY OF B.L. SHAPOSHNIK--On 12 September 1985 Boris Lvovich Shaposhnik a talented designer and scientist in the sphere of automobile equipment, Hero of Socialist Labor, winner of the Lenin and the USSR State Prizes, doctor of technical sciences, personal pensioner of All-Union status, and member of the CPSU since 1963, died in his 83d year after a serious illness. N.I. Ryzhkov,; L.N. Zaykov; N.N. Slyunkov; A.K. Antonov; L.V. Smirnov; A.I. Volskiy; O.S. Belyakov; V.N. Polyakov; P.V. Finogenov; Yu. D. Maslyukov; G.G. Bartoshevich; I. Ye. Polyakov; V.I. Brovikov; V.A. Lepeshkin; A.A. Malofeyev; B.A. Bashindzhagyan; G.S. Tarazevich; M.F. Lavrinovich; and A.D. Nadiradze. [Excerpts] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 15 Sep 85 p 3 PM] /9716

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CONFERENCES AND EXPOSITIONS

BRIEFS

PAN-EUROPEAN SCIENCE MEETING--The Pan-European Scientific Cooperation group studying the field of solar energy held a meeting in Ashkhabad today. The meeting included scientists from France, Bulgaria, Sweden, Hungary, Moscow, Leningrad, and others from fraternal Soviet republics. The meeting was opened by Sultanov, secretary of Turkmen SSR Academy of Sciences Presidium. [Summary] [Ashkhabad Domestic Service in Russian 1654 GMT 8 Oct 85 OF] /9716

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